The Engineering and Mining Journal

VOL. LXXXV. NEW YORK, FEBRUARY 15, 1908. NO. 7.

Metallurgy of the Kalgoorlie Goldfield

The Complex Ores Are Roasted Either before or after Concentration, and Fine-grinding Is Necessary for Extraction by Cyanide

BY GERARD W. WILLIAMS*

The metallurgical methods of the leading Kalgoorlie mines may be classified under two divisions:—(1) wet crushing, classifying and concentrating plants with or without bromo-cyanide; (2) all-roasting, dry-crushing plants with auxiliary fine grinding to slimes and filter-pressing. The word "slimes" as used in West Australia —and in this article—denotes a product sufficiently fine to be treated by agitation and filter-pressing. The bulk of these slimes will pass a 150-mesh screen, but they are not true slimes in the ordinary usage of the word. The accompanying table epitomizes the most important data in regard to the four plants in class (1):

VIEW OF GOLDEN MILE PLANTS, LOOKING NORTH FROM BOULDER MAIN REEF, KALGURLIE, WEST AUSTRALIA

*Metallurgist, Ida H. Gold Mining Company, Laverton, West Australia.

IVANHOE GOLD CORPORATION, LTD.

In the mill of this company the pulp from each ten head of stamps flows over two small pyramidal spitzkasten; the coarse and fine sands which underflow from the first and second of these cones respectively pass over two sets of ten Wilfley tables. The coarse sands, after concentration, are distributed over 11 grinding pans and the product from each pan passes into a launder whence it is delivered over 11 Wilfley tables. The sands from these tables, together with the fine sands from the first set of tables, run to the sump and are elevated by tailings pumps. The tailings pass over a set of spitzluten which return any coarse sands to the grinding pans, and the fine sands and slimes gravitate to the collecting vats. The slimes from the primary spitzkasten and the slimes from the collecting vats run to the settlers. The sands receive a five-day treatment. The slimes after settlement are pumped to the agitators, where they are diluted with weak solution in the ratio of one to one, ore and solution. After two hours' agitation 0.6 lb. bromo-

STAMP-MILL PRACTICE, KALGOORLIE.

Mine.	No. of Stamps	Monthly Tonnage.	Duty, Tons, 24 hr.	Weight of Stamp, Lb.	Screen.	Drop.	Drops Per Minute.
Ivanhoe.....	100	19,000	6.35	1200	15 x 15	7.5 in.	104
Golden Horseshoe.....	150	23,000	5.5	1270	15 x 15	8.0 in.	104
Oroya-Brownhill.....	50	11,000	7.35	1100	10 x 10	7.75 in.	108
Lake View Consols.....	70	1,100	5.5	1200	300 mesh.	8.0 in.	102

cyanide per ton dry slimes is added, and agitation continued for 12 hours. At the close of this period, lime, in amount equal to 1 lb. per 0.6 lb. bromo-cyanide is added. The slimes are then filter-pressed. The agitators are 20 ft. in diameter by 8 ft. deep, closed in and fitted with mechanical stirring gear. The concentrates, which represent about 8 per cent. of the tonnage milled are roasted in three Edwards furnaces. These concentrates contain 27 per cent. sulphur, together with the bulk of the tellurides. After roasting, the concentrates are mixed with spent cyanide solution, fine crushed in grinding pans, agitated with 0.1 per cent. cyanide and filter-pressed. The general treatment results are as follows: Gold recovered by amalgamation 28 per cent., from concentrates 13, from sands 17.5, from slimes 28 per cent., leaving 13.5 per cent. in the residues.

SCREEN ANALYSIS OF ORE IN VARIOUS STAGES.

Size, Mesh.	Leaving Mill.	Sands to Pans.	Product Leaving Pans.
	Per Cent.	Per Cent.	Per Cent.
On 40	24.0	31.4	0.6
40 to 60	17.5	21.8	6.2
60 to 100	12.5	17.6	28.7
100 to 150	6.5	6.1	8.0
Through 150	39.5	23.1	56.5

Total treatment costs, $2.20.

GOLDEN HORSESHOE.

The plant at the Golden Horseshoe consists of two separate portions, the "old" 50-head mill in which the procedure is essentially that described for the Ivanhoe, and the "new" 100-head mill which practices all-sliming. The mill pulp is elevated by a 45-ft. tailings wheel and distributed over ten classifiers. The coarse sands, 27 per cent. of the total product, pass over 12, and the fine sands over 11 Wilfley tables, the slimes overflow to the settlers. From the 23 primary tables three products are obtained, concentrates which go to the roasters, middlings which pass over four more tables and then to the tailings wheel, fine sands and slimes which are pumped to the sand traps. The underflow from these sand traps runs to 10 grit or tube mills, and the crushed product from these is delivered back to the sump. The tube mills are 16 ft. 4 in. long by 4 ft. in diameter, driven at 30 r.p.m.; they require 30 h.p. per mill and carry a load of five tons of flints, the consumption of which is 1.23 lb. per ton milled. The liners are Krupp chilled iron and have an average life of six months. The following are tube-mill costs for August, 1906; attendance 0.96 c., power 2.00 c., light 0.06 c., liners 4.52 c., flints 1.00 c., repairs 1.78 c., total 10.32 c. As 50 per cent. of the battery pulp passes a 150-mesh screen the costs per ton crushed through 150-mesh equals 20.64 c. The ratio of ore to water in the mill feed is two to three. The slimes from all sources are treated by agitation in vats holding 56 tons. The cyanide strength is made up to 0.06 per cent. and at the end of the period of agitation (usually about 18 hours) it averages 0.04 per cent. The total consumption of cyanide is 1.5 lb. per ton and an equal amount of lime is used. The sump and battery solutions average 0.007 per cent. cyanide. The concentrates are roasted in three Edwards furnaces and after fine-crushing in grinding pans are agitated and filter-pressed.

SCREEN ANALYSIS OF ORE, GOLDEN HORSESHOE.

Size, Mesh.	Battery Pulp.	Tube Mill Feed.	Tube Mill Discharge.	Sand, Leaching.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.
On 50	27.0	10.0	3.7	6.0
50 to 100	18.0	52.0	46.0	39.0
100 to 150	4.0	9.2	10.8	19.0
150 to 200	1.0	5.5	3.5	7.0
Through 200	50.0	23.3	36.0	29.0

The gold recovery is: from sands (old plant) 70.5 per cent., slimes 78.02; and concentrates 98.1 per cent.; or from all sources, 88.4 per cent. on $11.50 ore; the total treatment costs are $3.06.

OROYA-BROWNHILL.

The product from the 50-head mill on this property is classified on King's vibrating screens; the coarse sands pass through five grinding pans, the overflow from which rejoins the finer portion of the mill pulp and passes over ten Wilfley tables. The tailings leaving the tables are pumped to classifiers; the coarse sands gravitate to six tube mills and thence to the sump. The fine sands pass over six concentrating tables and back to the sump. The slimes overflow from the classifiers to the settlers and are treated by agitation with bromo-cyanide. The concentrates are roasted in three Merton furnaces.

The ore of this mine is especially highly mineralized and a large percentage of the gold occurs as a telluride. The consumption of chemicals is consequently high. The concentrates average 35 per cent. sulphur and 0.5 to 0.6 per cent. tellurium. The concentrates contain 42 per cent. of the total gold.

The tube mills are 13 ft. 7 in. by 3 ft. 8 in., and are driven at the rate of 31 r.p.m. The tonnage treated is equal to 300 tons per 24 hours. The ratio of water to pulp is three to five. Each mill carries a load of 2.85 tons of flints, occupying 5/8 the volume of the mill. New flints are added weekly and the mills relined once every twelve months; the liners are cast locally and are one inch thick.

SCREEN ANALYSIS OF ORE, OROYA-BROWNHILL.

Size, Mesh.	Battery Product.	To Pans.	Discharge FromPans.
	Per Cent.	Per Cent.	Per Cent.
On 20	21.66	30.00	2.05
20 to 40	20.66	26.82	26.00
40 to 60	7.32	9.85	15.20
60 to 100	9.56	7.27	11.0
100 to 150	1.86	2.20	2.87
Through 150	38.94	23.86	42.88

SCREEN ANALYSIS OF TUBE-MILL PRODUCT, OROYA-BROWNHILL.

Size, Mesh.	Feed.	Product.
	Per Cent.	Per Cent.
On 20	1.2	0.2
20 to 40	7.1	4.3
40 to 60	10.5	9.8
60 to 100	45.5	43.6
100 to 150	19.1	18.7
Through 150	16.6	23.4

Total treatment costs were $3.36. The total recovery averages 95 per cent. on $25 ore.

LAKE VIEW CONSOLS.

The metallurgical methods at this mine are generally similar to those at the Oroya-Brownhill. The accompanying table illustrates the more important gradings:

FINENESS OF PULP IN DIFFERENT OPERATIONS, LAKE VIEW CONSOLS.

Size, Mesh.	Battery Pulp.	Tube Mill Feed.	Tube Mill Product.	Slimes.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.
On 30	15.00	6.00		
30 to 60	21.34	12.00	2.87	
60 to 80	13.34	24.05	16.71	
80 to 100	4.11	8.93	10.64	
100 to 150	7.55	19.85	21.37	5.21
150 to 200	2.39	15.18	22.95	6.66
Through 200	36.27	13.96	24.96	88.13

There are three 16 ft. 3 in. x 4 ft. and three 12 ft. x 4 ft. tube mills. The former carry a load of 4.5 and the latter of 3.5 tons of flints. All mills are driven at 29 r.p.m. and require 30 and 25 h.p. respectively. About 300 tons of sand pass through each mill per 24 hours and the consumption of flints is the same in both sizes of mill; but the crushing capacity of the large mill is 35 tons as against 28 tons per day for the smaller mills The liners are of manganese steel, one inch

OROYA-BROWNHILL BATTERY AND FINE-CRUSHING COSTS FOR SEPTEMBER, 1907.

Department.	Labor.	Power.	Repairs.	Assay.	Water.	Shoes and Dies.	Sundries	Totals.
Battery (10,640 t.)	9.46	19.78	8.74	0.34	2.28	2.22	1.64	44.46
Fine-grinding....	6.76	16.72	13.7	0.12	1.48	....	1.00	39.78

thick and are worn down to between ¼ and ⅛ in., the consumption per month being about 250 lbs. A total recovery of 85 per cent. is obtained. The concentrates contribute 57.5 per cent. and the slimes (by bromo-cyanide) 27 per cent. The ore milled averages $7.50. The total treatment costs are $2.42.

All-Roasting Plants.

The all-roasting plants in division No. 2 of the mills at Kalgoorlie are naturally characterized by greater uniformity than the wet-crushing plants previously described. The more important data are epitomized in the accompanying table:

EQUIPMENT OF ALL-ROASTING PLANTS, KALGOORLIE.

Mine.	Tonnage Per Month.	Value Per Ton.	Primary Milling Plant.	Roasters.	Secondary Grinding Pans. Number.	Secondary Grinding Pans. Diameter.	Recovery, Per Cent.	Costs, Treatment.
Great Boulder	14,000	$17.0	2, No. 8 Krupp. 12, 30" Griffen.	12 Edwards. 8 Merton.	12	5 ft.	91.0	$2.74
Perseverance	16,000	9.0	16, No. 11 Griffen.	6 Edwards— Persev'rance	14	8 ft.	91.5	2.76
Kalgurlie	10,000	15.0	9, No. 5 Krupp.	15 Edwards.	15	5 ft.	94.5	2.88
South Kalgurlie	8,700	7.5	2, No. 8 Krupp. 1, No. 5 Krupp.	8 Merton.	5	8 ft.	94.2	2.88
Associated	9,000	10.0	10, No. 5 Krupp.	18 Merton.	20	5 ft.	90.0	2.76
Associated Northern	3,500	19.0	3, No. 5 Krupp.	5 Merton.	8	5 ft.	92.5	2.98

Generally speaking the ore is dry-crushed in Krupp or Griffin mills, roasted in Edwards or Merton furnaces and after fine-crushing in grinding pans is agitated and filter-pressed.

In regard to primary grinding the Krupp mill is replacing the mills of the Griffin type. At the Kalgurlie the nine No. 5 Krupp mills, eight of which are kept in continuous use, are capable of putting through between 10,000 and 11,000 tons per month. These mills maintain a duty of 45 tons per 24 hours when crushing through a 37-mesh screen. The load of balls weighs about 2300 lb.; one 18-lb. ball is added every day to compensate for wear and tear. The mills run at 25 r.p.m. and require, including their share of countershaft friction and dust fans, 25 h.p. At the Great Boulder both Griffin and Krupp mills are in use. The latter are 8 ft. 6 in. in diameter by 4 ft. wide, carry a load of 3800 lb. of 5-in. balls and at 22 r.p.m. require about 60 h.p. These mills crush 90 tons per day through a 28-mesh screen, running 93 per cent. full time.

The Griffin mills, 12 in number, are provided with a heavy base ring of cast steel and a bed plate of cast iron one inch thick. When sticks of explosive get into the mill the bed plate gives out and the expensive ring is saved. These mills run at 200 r.p.m. and average 30.8 tons per 24 hours; 12- and 15-mesh screens are used.

The power required is equal to 0.68 h.p. per ton crushed. The cast-steel die and tire rings last 27 to 30 and 9 to 10 days respectively. The mild-steel spindles last about 90 days.

In costs per ton milled the Krupp mills are somewhat lower than the Griffin mill; the product from the former mill is also found to give a better roast in the furnaces, being less liable to cake than the finer, more angular product from the Griffin mills. The following table shows typical gradings of the product from both type of mill.

ROASTING FURNACES AT KALGOORLIE MINES.

Mine.	Type of Furnace.	Area of Hearth.	Average Tonnage. (24 hrs.)	Sulphur in Ore.	Fuel Consumption. (Wood.)	Cost Per Ton. †
				Per Cent.	Per Cent.	
Associated Northern	Merton.	630 sq.ft.	22	5.0	12.2	61c.
Kalgurlie	Edwards.	70' x 9' 6"	23	4.2	13.0	68.4
Kalgurlie	Edwards.	63' x 9' 0"	22	4.2	13.0	
Perseverance	Edwards.*	121' x 13' 6"	93	4.0	11.0	65.8
Great Boulder	Edwards.	64' x 6' 6"	25	3.5	9.2	59.2
Great Boulder	Merton.	422 sq.ft.	25			
South Kalgurlie	Merton.	617 sq.ft.	36	3.8	10.6	64.0
Associated	Merton.	445 sq.ft.	20	6.1	10.0	63.0

*"Perseverance Type." Cooling hearth under furnace equal in area to floor of roaster. †Feed represents about 50 per cent. total roasting costs.

SCREEN ANALYSIS OF PRODUCT OF BALL AND GRIFFIN MILLS.

Size, Mesh.	Ball Mills. Great Boulder.	Ball Mills. Associated Northern.	Ball Mills. Kalgurlie	Griffin Mills. Great Boulder.	Griffin Mills. Perseverance.
	%	%	%	%	%
On 20	0.22	0.22	....	1.07	2.3
20 to 40	5.21	6.40	1.3	1.01	11.8
40 to 60	15.74	15.25	14.9	3.36	
60 to 80	6.64	10.35	15.3	4.60	8.3
80 to 100	8.00	7.95	9.5	5.99	
100 to 120	1.67	3.70	2.9	1.27	6.8
120 to 150	6.32	4.10	4.3	10.00	
150 to 200	5.80	52.03	6.2	4.38	7.6
Through 200	50.33	.....	45.6	67.72	63.2

Milling costs are 55c. at the Perseverance (Griffin mills); 70c. at the Great Boulder (Griffin and Krupp mills); 79c. at the South Kalgurlie and 59c. at the Associated and Associated Northern (Krupp mills).

Roasting.

Edwards and Merton roasters are used. The latter possesses the advantage of requiring a smaller area. This furnace is a three-hearth roaster. At the Associated Northern the two upper hearths are 23x8 ft.; the lower hearth is carried forward an extra 10 ft. The hearths are horizontal and open alternately at the end, from one to the other. The ore is moved forward by means of revolving cast-iron rabbles, the two rabbles on the forward portion of the lower hearth being water cooled.

Two types of the Edwards furnace are in use, the smaller, normal type with a fire-box at one end, and the larger, "Perserverance" type with a fire-box at the end and two others, one on each side of the furnace. This furnace is provided with a return cooling-hearth which extends along the under side of the roasting floor. Push conveyers are universally used for handling the roasted ore.

As the result of experiments conducted at the Great Boulder it was found advisable thoroughly to cool the roasted ore before mixing with the cyanide solution. To effect this a series of push conveyers have recently been installed. The ore travels about 350 ft. and is thoroughly cooled down before mixing, when solution of the gold takes place with greater rapidity. This is not surprising, for in many cases the ore is so hot when mixed that the solution leaves the mixer almost if not quite at boiling heat. Hence but little dissolved oxygen remains in the solution. The subsequent grinding process is usually depended upon to supply all needful aeration.

Grinding.

From the mixers the ore is delivered to the grinding pans. These pans are usually of the Forewood-Down type of Wheeler pan; two sizes are used, 8 ft. and 5 ft. in diameter. The question of fine-grinding will be considered in detail later on. At the Associated Northern and South Kalgurlie mines the pulp from the mixers is delivered directly to the grinding pans. The system at the latter mine is as follows: The pulp from the mixer is delivered to one pan, and the overflow from this pan is divided over two other pans, each of which in turn overflows to another pan. The product from these five pans passes two spitzkasten and the coarse underflow is returned to two more

pans. The pans in the first series are 8 ft. in diameter and the two pans in the second series 5 ft. in diameter. The five 8-ft. pans are driven at 33 r.p.m. and require 11 h.p. per pan. About 25 per cent. of the value of the ore milled is recovered by amalgamation in the pans.

At the other mines the ore is classified prior to fine grinding. The aim of the metallurgist is to produce a final product, 90 per cent. of which will pass a 120-mesh screen. This appears to represent the present economic limit of fine-grinding, and it is significant that at the Great Boulder where the pans were formerly arranged in two rows of 12 each, the upper row discharging into the lower, the use of the lower row has recently been discarded, the slight increase in the extraction being more than counterbalanced by the increased cost. The following table, compiled from official figures, represents the sizes of the final product from representative mines.

SCREEN ANALYSIS OF FINAL PRODUCTS FROM FILTER PRESSES.

Size, Mesh.	Great Boulder.	Associated Northern.	Kalgurlie.	Perseverance.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.
On 30				
30 to 40	....	0.71		
40 to 60	0.21	1.30		
60 to 80	0.68	1.15	....	3.9
80 to 100	3.06	1.10	2.1	
100 to 120	2.29	1.23	2.1	13.7
120 to 150	3.55	5.10	6.0	
150 to 200	11.59	89.41	13.4	11.8
Through 200	78.62	....	76.4	70.6
Extraction.....	91.0	92.6	94.5	91.5
Average value....	17 dwt.	19 dwt.	15 dwt.	9 dwt.

Amalgamation is effected in the pans at all mines except the Kalgurlie. At the latter mine 95 per cent. of the total gold occurs as a telluride. No mercury is used in the pans. Every month any coarse gold remaining on the bottom of the pan is cleaned up and amalgamated in a Berdan pan. About 5 per cent. of the total gold is recovered in this manner. The elimination of pan amalgamation does away with all possibility of loss of gold through flouring of the mercury and the management states that residues have fallen since amalgamation was discarded.

Agitation and Filter-pressing

After fine-grinding the ore passes to the settlers and from these is drawn off to the agitators where the cyanide strength is brought up to about 0.1 per cent. The usual ratio of slime to solution in the agitators is about two to three. At the Kalgurlie the agitators consist of 20 vats each 6 ft. in diameter and 12 ft. 6 in. deep. The floor of each vat slopes to the centrally situated exit pipe. The slimes are agitated by means of a small stream of compressed air at 30 lb. pressure. The whole set of these agitators only occupy a floor space of 110 sq.yd. Each agitator contains 4.75 tons of dry slimes and is discharged directly to the filter presses which are six in number and treat slightly under five tons at a time.

At other mines the agitators are larger, and are agitated mechanically. A vat 20 ft. in diameter capable of containing 60 tons of pulp (equal to 40 tons dry slimes) with the agitator making 8 r.p.m. requires from 3 to 4 h.p. The agitators are so arranged that they can be raised out of the pulp on a windlass. All danger incidental to a stoppage in the power is thereby overcome.

The filter presses are usually of the angle-closing type but most of the newer presses are closed hydraulically. Montejus and direct-acting plunger pumps are used for filling. After the press is filled which usually occupies about 25 minutes, the contents are given two 20-minute washings and are then usually dried for a few minutes with compressed air at 60 to 80 lb. pressure. The residual moisture varies from 15 to 20 per cent. The cost of filter-pressing averages about 30 c. and labor costs amount to about 50 per cent. of this.

The consumption of cyanide at the all-roasting plants averages 0.6 lb. per ton. Lead acetate, one pound to every five tons, is added in the mixers to counteract the effect of soluble sulphides and thiocyanates in the roasted ore. Lime is not used, for the roasted ore contains sufficient to keep the solutions alkaline.

Tube Mills and Wheeler Pans

The difficulty of correlating mining practice in this field is considerably enhanced by the fact that apart from differences of treatment the ore from adjoining mines varies considerably both in hardness, distribution of the gold and mineral content. Thanks to the kindness of the several mine managers I was enabled to investigate very thoroughly the metallurgical conditions prevailing at each mine and was afforded every facility in the matter of obtaining data and costs.

The question of fine-grinding is of the utmost importance in this district for even after the closest possible concentration of the wet-crushed ore it is not possible to obtain efficient extraction without fine-crushing the bulk of the mill product to slimes finer than 150- or 200-mesh. This fine-crushed product is very difficult to treat and causes a large consumption of chemicals. At the roasting plants fine-crushing is equally necessary, for even if good extraction were possible by leaching the roasted ore, the presence of calcium sulphate which is produced during roasting would necessitate the use of explosives in discharging the vats.

The roasted ore is naturally more friable than the green ore and hence all comparisons must be based on mines employing similar methods. In regards to the fine-crushing of unroasted ore both tube mills and Wheeler pans are in use. The latter are usually 5 ft. in diameter, but considerable variation exists in the arrangement of the shoes on the muller. In a series of experiments conducted at the Ivanhoe plant, tests were made as to the relative efficiency of tube mills and grinding pans. In the most successful of these experiments the pans being used in tandem with the object of reducing the total mill product to slimes, the following data were obtained: The pans were 5 ft. in diameter and driven at 57 r.p.m.; each required 6.5 h.p. The grinding weight was 2500 lb. The tube mill was a Krupp 13 ft. 3 in. x 3 ft. 3 in. mill loaded with 5917 lb. of flints, driven at 31 r.p.m.; the mill required 20 h.p. The whole feed from 20 head was run on alternate days through the tube mill and through the pans. The test lasted for 20 days.

The whole product of the mill passed to the first pan and then to a spitzkasten. The underflow from this went to a second pan and the overflow from this pan was returned to the spitzkasten. When the mill was used the battery product passed direct to the spitzkasten and the underflow after passing through the tube mill was returned to the same spitzkasten. The accompanying tables show the results.

SCREEN ANALYSIS OF PRODUCT OF PAN GRINDING

Size, Mesh.	Feed, 1st Pan.	Feed, 2d Pan.	Product, 2d Pan.	Final Product.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.
On 40	39.45	0.39		
40 to 60	16.83	6.99	1.10	
60 to 100	12.97	35.40	21.13	0.88
100 to 150	4.19	24.34	24.69	4.03
Through 150	26.56	32.88	53.08	95.09

The feed to the tube mill consisted of the underflow from the spitzkasten which received the battery product and the product from the tube mill.

SCREEN ANALYSIS OF TUBE MILL PRODUCT.

Size, Mesh.	Feed.	Product.	Final Product.
	Per Cent.	Per Cent.	Per Cent.
On 40	11.40	2.74	
40 to 60	14.98	11.67	
60 to 100	36.94	36.00	0.64
100 to 150	17.77	18.90	3.74
Through 150	18.91	30.68	95.62

The mill crushed 29.1 and the two pans 26.2 tons per day through the 150-mesh screen. The costs per ton in the two experiments were as follows, power being calculated at 33 c. per h.p. day:

	Pans.	Tube Mill.
Power.....	19.34c.	32.60c.
Wearing-parts..... ...	29.30	21.74
Labor.....	2.62	3.38
Repairs and supplies..	3.56	3.70
Total.....	54.82c.	61.42c.

The results most favorable to the pan were obtained when the tube mill was used for the reduction of coarse sands to finer sands (as is done on the Rand). In these tests the pans showed a much greater efficiency than the tube mill. The best arrangement was shown to be that utilizing the pans for reducing the coarse battery product to fine sands and feeding this product to the tube mill.

One pan working on coarse sands can produce 11 tons of finer than 150-mesh product per day; working on fine sands the tonnage is increased to 14 tons per day. Under similar conditions the tube mill produced 19 and 24 tons respectively. The feed to the tube mill was from 140 to 160 tons per day, the ratio of ore to water being 1 to 1.25.

In the all-roasting plants grinding pans alone are used. The greater friability of the ore after roasting renders this type of fine-grinding particularly applicable, for there seems little doubt that on hard ore the tube mill is more economical than the grinding pan. On the Rand, for example, where the ore is extremely hard it is found that all-crushing must be by impact and not by attrition. A grinding pan was recently tried on the Primrose mine (Transvaal), and the wear and tear of the shoes and dies was equal to 5 lb. of iron per ton crushed. With the tube mill, wherein the crushing is essentially by impact between the flints, satisfactory results are obtained even when the mill is worked under the least favorable conditions, that is, for the reduction of coarse sands to fine. From its petrological nature the Kalgoorlie ores are well adapted to grinding by attrition and this is especially true in the case of roasted ores.

Efficiency of Grinding Pans

In regard to the efficiency of grinding pans the following generalizations may be drawn from current Kalgoorlie practice:

(1) Other things being equal the grinding efficiency is proportional to the circulation. Circulation varies directly as the interspaces between the shoes and as the depth of the shoes. Where the shoes are set close together, that is, with one inch interspace on the circumference of the muller, the circulation falls off rapidly as the shoes wear down. Consequently the pan must be driven at a higher speed to maintain the tonnage. When the shoes are wider set a lower speed will maintain the same average efficiency.

(2) For any given arrangement the grinding effect is proportional to the power expended. Coarse sands grind best at high speed, fine sands at medium speed. A small increase in speed involves a high expenditure of power. At the Perseverance mine it was found that increasing the speed of an 8-ft. pan by 14 per cent. raised the power requirement 58 per cent.

(3) Other things being equal, the grinding effect is proportional to the shoe area.

(4) The pans are most efficient with an overload of 10 per cent.

(5) From 25 to 33 per cent. of solids in the pulp appears to be the average for efficient grinding.

(6) Uniformity of feed is necessary for high efficiency.

At the Kalgurlie the pans 5 ft.. in diameter, run at 53 r.p.m.; at the Oroya-Brownhill similar pans run at 51 r.p.m.; and at the Great Boulder the same pans run at 62 r.p.m. The latter pans require 4.5 h.p.

At the Perseverance and the South Kalgurlie 8-ft. pans are used; they run at 27 r.p.m. and at 31 r.p.m. respectfully, the power required being 6 and 9 h.p. respectively. On the whole plant the sands slimed amount to 1.4 tons per h.p. day. The abrasion averages 13.25 oz. per ton crushed. The abrasion in the 31-r.p.m. pans is 38.3 per cent. more than in the 27-r.p.m. pans. At the South Kalgurlie the 8-ft. pans run at 33 r.p.m. and require 11 h.p.

One of the chief defects of the pan lies in the fact that the circulation diminishes as the shoes wear down and consequently the grinding power falls off. This may be counteracted by increasing the speed at which the pan is driven, but this is not practicable, consequently the pans are driven at such a speed that when the dies and shoes are worn down the grinding efficiency will be maintained at the required point. This naturally involves a certain waste of power when the shoes are new. Compensating weights are used at some mines; these are affixed to the upper surface of the muller and are added as the shoes wear down. A new pan, the Cobbe-Middleton, has recently been working on the Hainault. This pan embodies some new features. The bottom of the pan is balanced by cross levers against the muller which is fixed. The crushing weight is thus kept constant during the whole run. By a system of bent levers the grinding weight automatically adjusts itself to the wear and tear. The shoes are constructed with a false rim which increases the circulation without adding to the weight.

Precipitation and Clean-up.

All solutions are clarified before precipitation by being passed through a filter press. The methods in vogue in the extractor houses call for no special comment. In the wet-crushing, bromo-cyanide plants mercury, derived from the mercury telluride often present in the ore, is deposited on the zinc and materially aids the precipitation of the gold. In some plants which treat roasted ore small quantities of mercury chloride are added to the solutions entering the boxes to increase the efficiency of precipitation. At nearly all plants the zinc in the "weak" boxes is dipped in lead acetate.

Martins tilting furnaces are largely used for melting the calcined precipitates, which in some cases are calcined without previous acid treatment. At the Golden Horseshoe the zinc is scrubbed through a 20-mesh screen, calcined direct and smelted with 25 per cent. of fused borax and 10 per cent. of sand. The resultant bullion assays 700 fine gold, 260 silver, and 40 base metal. The calcined slimes contain about 50 per cent. of bullion.

General Metallurgical Considerations.

All the plants are "continuous-process," that is the ore is in contact with cyanide solution throughout the course of treatment. In the wet-crushing plants the battery water contains from 0.003 to 0.007 per cent. potassium cyanide. Fresh water is used only in the filter presses. At the all-roasting plants the cyanide strength of the solutions in the mixers varies from 0.003 to 0.05 per cent., but 0.006 per cent. may be taken as the usual strength. The clear solutions which overflow from the slimes settlers are not usually precipitated till they assay about 3 dwt. Below this value the solutions are returned directly to the mixers. All floors are cemented and well drained. Steel launders are universal, and every effort is made to reduce to a minimum the losses incidental to carelessness of employees. In fact in most plants it is almost impossible to cause actual loss of the gold-bearing solutions.

The continuous-treatment plants of Kalgoorlie are the outcome of long experiment, and it is only by their aid that the economic handling of these complex ores has been made possible. The continuous method has certain disadvantages, the most obvious being the potentialities of loss and the large amount of gold carried in solution. On the other hand no time is wasted in effecting solution. At the Kalgurlie mine for example, where a 15-dwt. ore is treated without amalgamation, the fine-crushed slimes passing to the agitators contain only about 4 dwt. of undissolved gold. The period of agitation is consequently greatly reduced. Nor can this method be accused of fostering a high cyanide consumption, for at the all-roasting plants the consumption of cyanide from all sources averages from 0.5 to 0.7 lb. per ton. This figure is not excessive when the fact that the solutions are saturated with calcium and magnesium sulphates (derived from the roasted ore) is taken into consideration. The cyanicide properties of these salts is well known.

The all-roasting plants are more economical than the wet-crushing mills. From the nature of the ore the cost of chemicals, cyanide, bromo-cyanide (and royalty on this process), and lime are far in excess of the roasting plus cyanide costs of the dry-crushing plants. For example, cyaniding by agitation costs $1.82 (including 41 c. royalty) at the Oroya-

Brownhill, and 72 c. (including 3 c. royalty) at the Lake View. From 85 to 90 per cent. of these costs, which relate exclusively to actual cyanidation and have no reference to other reduction costs, are for chemicals. Moreover, the green ore is naturally less easily fine-crushed than the roasted ore and it is necessary to reduce it to a fine degree of comminution to obtain the same percentage extraction as that secured in a roasting plant. In addition the wet-crushing plant has to maintain an extensive series of mechanical concentrators and the product from these must be roasted before treatment.

Distribution of Labor

The more modern plants are designed with special regard to the limitation of labor. Filter-pressing is responsible for about 30 per cent. of the total labor in the plant, but the new Ridgeway automatic filter-press which has been running successfully at the Great Boulder for some months has effected a marked reduction in the labor required. At this plant three men can do the work of 27 men in the ordinary filter-press plant. This press is based on the vacuum principle. Flat paddles or plates, covered with filter cloth and connected with the air exhaust are rotated in a circular trough. This trough is divided into three portions: one for the slimes, one for wash solution and water and one portion through which the washed slimes are discharged by releasing the exhaust. The outer edge of the filtering frames, each of which has 4 sq.ft. of filtering area, are attached to a circle 12 ft. in diameter. The annular trough is also 12 ft. in diameter and the filter frames run on small wheels on the outer rim of the trough. The filter arms are lifted from one portion of the trough to the other by the small wheel running up an incline at the side of the trough and drops down again on the other side. The lifting of the frames actuates a set of centrally placed valves which divert the solutions to the strong and weak sumps respectively. Each frame is a complete unit. The whole apparatus makes one revolution per minute and requires about ½ h.p. Working costs are about 9 c. per ton.

The following table shows the labor-distribution sheet of the Kalgurlie plant. The capacity of the plant is from 9000 to 10,000 tons per month.

LABOR REQUIRED AT THE KALGURLIE PLANT, THREE SHIFTS PER 24 HOURS.

Rock-breakers	4 men.
Aerial tramway	5 men.
Ball mills	3 men and 3 boys.
Furnaces	9 men.
Classifiers, settlers & agitators	9 men and 1 boy.
Grinding pans	3 men.
Filter presses	15 men.
Removing residues	9 men.
Dustmen, etc	3 men.
Handymen	7 men.
Foremen	3 men.
Total	70 men and 4 boys.

Mining Notes from the Transvaal

Special Correspondence

The latest figures show that there are now at work on the Rand 64 tube mills used in connection with the stamp batteries. The average duty per stamp has risen, in consequence of the tube mills, to 5.79 tons per 24 hours. The mines do not appear to be sorting as closely as formerly, for on the average only 15.56 per cent. of the rock from the mine was thrown out as waste. As regards value of ore per ton crushed, the Robinson mine heads the list with $13.46 per ton, while the Ferreirra Deep is second with a recovery value of $12.22. The two lowest are those of the Glencairn Main Reef and the Lancaster mines, where the recovery value was only $4.31 per ton. To work these mines for such a low return proves that strict economy is being exercised.

There has been an appreciable falling off in the number of accidents in the mines of the Rand during the past six months. Good luck has had a great deal to do with the improvement, for there has been none of those disasters where 75 or 100 men are knocked out at one time, thereby swelling unduly the accident death roll. Increased care is being taken to prevent accidents in the mines, and it is satisfactory to note that the efforts of the authorities are meeting with such success.

Much comment has been occasioned by the action of the Government in dismissing H. Weldon from his post of Government mining engineer, and putting in his place Mr. Kotze. For several years Mr. Weldon has filled his post with great credit to himself, and satisfaction to the public. But as the Boer party is in control, he had to go. His friends are glad, however, that he accepted the position of chief inspector of mines for the Rand. Mr. Kotze knows a good deal about mines, having received a sound training in mining. He should fill this important post of Government mining engineer with ability.

The stope drill competition, organized by *South African Mines*, is now in full swing, and is attracting much attention. The contests are being held at the Robinson mine, and most of the makers of little drills have entered the list with their machines. The idea is to find out the most suitable machine for narrow stoping and it is to be hoped that the contest will help to solve the most pressing mining problem of the Rand, how to replace a diminishing labor supply with a machine that will break rock effectively. It is too soon to state what machine will win the trophy offered, but it is of interest to note the fine showing made by the Gordon drill in these trials. As this machine is a local design, people here are glad to see it doing so well. The Gordon drills are being sold by an old established firm in Johannesburg, and should this machine succeed in winning first prize there should be a good market for them. As long as there is sufficient labor, however, most managers prefer to work their narrow reefs by hand, as they maintain that no machine can be devised to compete with efficient Kafirs in narrow stoping widths.

Buffalo Mines Company, Ltd.

The report of the Buffalo Mines Company, Ltd., for the period from May 1 to Nov. 1, 1907, shows that during this time development included 64 ft. of shaft sinking, 1244 ft. of drifts and crosscuts, a little stoping, open cut work and prospecting. About 9000 tons of ore were raised from shafts Nos. 4, 5 and 6, of which 600 tons were shipped and the balance added to the stock pile. The strike among the miners delayed underground work and mill construction and cut down the number of men employed during the summer months.

A concentrating plant containing rolls, a Huntington mill, Wilfley tables, vanners, slime tanks and cyanide vats was installed in November. The capacity of the mill is about 50 tons per day but this may be increased to 200 tons at comparatively litue cost.

It is interesting to note that considerable lead was encountered in Nos. 1 and 2 drifts, in one case the lead content of the vein being 7 per cent.

The gross returns from 660 tons of ore, containing 319,000 oz. silver, was $214,064; from 9 bars of bullion, containing 4255 oz. silver, $2708; total, $216,772. The net returns, after deducting freight and treatment charges were $187,677.

The total net earnings were $108,323, of which $54,000 was paid in dividends, leaving a surplus of $54,323. To this is added $27,998 (previous surplus and adjustments) which gives a total surplus of $82,321, not including $18,000 for ore shipments outstanding.

Petroleum Lakes on Sakhalin

Wilbur T. Gracey, United States consul at Tsingtau, China, reports that large petroleum wells have been discovered on the island of Sakhalin, and that also a lake of petroleum has been found in the same district. The lake and wells have been discovered by Russian engineers, and have been reported to the Russian mining department. It is reported that the department will place foreigners on the same footing as Russians in the development of the discoveries. The wells and lake are situated on the northeast coast of the island of Sakhalin, near Nabil Bay, in the Russian section of the island. The place is said to be easily accessible to steamers.

The Merits and Demerits of Air-hammer Drills

The Collar Shank Still Seems to Be the Best Means of Preventing the Steel from Following the Hammer

BY G. E. WOLCOTT*

Some time ago I predicted[1] that the air-hammer rock-drills would almost entirely replace piston machines for overhead stoping operations. So far as the Cripple Creek district is concerned, this prediction is being fulfilled. At present there are only two large companies in the district that do not use the air-hammer drills either entirely or in part for their overhead work.

The rapid introduction of air-hammer drills during the past few years is ample proof that they possess real merits for the work to which they are applied, especially when we consider the fact that mining men are inclined to be ultra-conservative. The air-hammer drill has not as yet reached its highest stage of development, but it has at least emerged from the experimental stage.

As originally constructed the air-hammer machines were intended for light work, such as block-holing and for use in narrow veins where the larger machines could not be used advantageously. The main advantage of the air-hammer drill was that it could be readily carried from place to place and, being held by the operator, could be used in any place where single-jacking had before been necessary. The use of the stoping bar with this style of machine marked the first great step toward its general introduction for stoping operations. It has made possible the use of larger machines with heavier construction and made them applicable for drilling harder rock. Just what the limit in size of these machines will be, is difficult to forecast. At present machines weighing, complete with stoping bar, 60 to 70 lb., are common and heavier machines of the self-racheting type have been built, but are not in very general use.

Two considerations limit the size and power of the air-hammer drill. As this drill is designed to operate without a set-up, it must be light enough to be readily handled by the operator. This feature would seem to limit it practically to a weight of not much more than 100 lb. at the most. Besides with the more powerful machines the tendency for the drill steel to crystallize and break increases with the size of the drill. At present the only solution of this difficulty, so far as I know, is in the use of larger steel in proportion to the power of the machine. Steel manufacturers should try to produce a drill steel that will not crystallize, or in which the tendency to do so will be reduced to a minimum, so as to meet this demand.

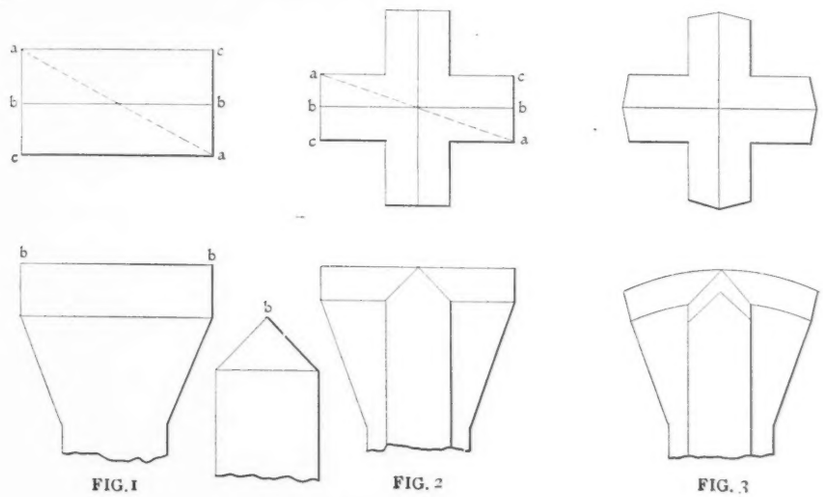


FIG. 1 FIG. 2 FIG. 3

VARIOUS SHAPES OF BITS, USED WITH AIR-HAMMER DRILLS

Different Forms of Bits.

As first manufactured, the drill steel for these machines was usually made with a rose bit of six or more cutting edges; hollow steel was used so that the cuttings could be blown out of the hole by passing part of the exhaust air through the steel. The only advantage gained by the rose bit is that the cuttings are finer and the drillings are more readily blown out by the exhaust air. With the exception of this, it has little to recommend it and is rapidly going out of use except for drilling boulders with the light hand machines.

At present there are three main types of bit used with these machines in the Cripple Creek district. These are illustrated in Figs. 1, 2 and 3. The first is commonly called the bull bit and is made either as illustrated or with the sides slightly drawn in below the points *b b* in the side view. In either case it should be so made that the distance *a a* is greater than the distance *b b* (plan view). The same point should be observed in making the cross bit, Fig. 2. By observing this condition the edges *a b* and *b c* act as reamers to cut away the outer circumference of the hole. If these edges become rounded, it becomes difficult to turn the bit in the hole. This difficulty is overcome, in the third style of bit illustrated, by rounding off the cutting edges as shown. The degree of curvature may vary appreciably, but is usually not very great. This bit has been in use a comparatively short time but has given great satisfaction wherever used. This bit not only cuts rapidly but it also gives less trouble in turning than either of the others illustrated, and will cross slips more readily. It is possible to use this bit in a hole that has become reamed when drilling with a square bit and with but little difficulty to cut out the reams and start the drill to turning again. This is also true regarding a hole reamed by a bull bit.

Different Forms of Shank Used.

As first introduced these machines were always made so that the hammer struck directly against the end of the steel; for this reason it was necessary to put a collar on the steel at a distance from the end slightly greater than the length of the chuck in order to prevent the steel from following the hammer on the down stroke. The shape of the shank may vary to suit individual taste, being usually either square, hexagonal or cruciform; the only essential feature is that the shank must not turn in the chuck.

This collaring of the steel has been found to be a great drawback since the tendency of air-hammer steel to crystallize and break especially at the shanked end is great; therefore the collaring of the steel becomes a frequent necessity. On this account several methods have been devised to prevent the necessity of

*Mining engineer, Cripple Creek, Colo.

[1]The JOURNAL, July 20, 1907, p. 117.

a collar but none of these has as yet proved entirely satisfactory.

Two of the methods that have been extensively used are illustrated in Figs. 4 and 5. The first shows the false-chuck arrangement which is simply a piece of steel made to receive the end of the drill and having a projection, *K*, fitting into the chuck of the machine, which receives the blow of the hammer. This device is entirely satisfactory for the purpose for which it is designed but brings in other difficulties, which more than counteract the advantage gained: (1) The false chuck is itself subject to breakage and is more costly to replace than the shank of the steel; (2) a large part of the force of the blow is lost in the false chuck, thus decreasing the drilling capacity; (3) the false chuck, not being attached to the machine, is frequently knocked out by the hammer and falls down the stope, causing much annoyance.

The second arrangement, that in which the striking pin or tappet is used, is more satisfactory, as the third objection mentioned above is overcome. However, the other two objections still remain; in fact, when broken, the striking pin is more difficult to replace than the false chuck. An advantage of the striking pin is that it prevents, to a large degree, the escape of the exhaust air around the shank of the steel and also prevents dust and rock from reaching the hammer.

The method of applying the striking pin is shown in Fig. 5. The barrel of the machine is *b b; c c* represents the chuck, which is either screwed, shrunk or bolted in place, and *t*, the tappet or striking pin. The end of the steel rests against the upper end of the tappet, while the hammer hits the lower end. The force of the blow is thus transmitted through the tappet to the steel. It is evident that a part of the force of the blow will be lost in the tappet and that the force lost will depend upon the weight of the tappet and the pressure with which the steel is held against it; this latter depends again upon the air pressure applied to the stoping bar. In order therefore to maintain a high drilling efficiency the tappet should be as small as is consistent with the requisite strength and the air pressure should be as great as possible without making it difficult to turn the steel in the hole.

Best Way to Put Collar on the Drill Steel.

In my opinion the best way to overcome the difficulty of collaring the steel is to simplify the collaring process. Under proper conditions the process of collaring the steel is no more difficult than sharpening a bit; by using the best quality of steel of a size proportionate to the power of the machine the breakage should not be excessive. Where a shanking machine is used there is of course no difficulty, for one man can do the shanking faster than another can heat the steel in an ordinary blacksmith furnace.

Where the number of machines used does not warrant the expense of a shanking machine the operation is a little more difficult, but it is still a simple matter if the proper tools are at hand and a shank is used of the same size and shape as the steel. A simple tool, such as illustrated in Fig. 6, greatly facilitates the shanking operation. This is made in the form of a die having the hole of the size and shape of the steel and a depth equal to the length of the shank. It should be so made as to be readily attached to a heavy block of wood or some other substantial foundation. In the form illustrated the projection, *P*, is simply inserted into a square hole in a block of wood.

To collar the steel the end is first squared off and the steel heated at the point where the collar is to be upset. The collar is placed in the die and then the steel is driven through it from the bit end, the sharpening dolly being used to protect the bit.

The larger sizes of the air-hammer drills should not use less than 1-in. hexagon or 1⅛-in. ribbed steel. Lighter steel is cheaper in first cost but the heavier is cheaper in the end.

Types of Air-Hammer Drills.

Two general types, the valve and the valveless machines, have been introduced; the striking pin may be used with either of these. Fig. 7 shows the principle upon which the valveless machines work. As shown the hammer *H* is on the forward stroke and the air entering at *I* passes through the ports *P* in the hammer and exerts a forward pressure over the entire rear portion. At the same time the exhaust, *E*, has allowed the escape of the compressed air from the previous stroke and the inner ring, *R*, which is a part of the barrel, *B*, prevents the air from the inlet from going to the front of the hammer. The effective air pressure then is the pressure on the rear portion of the hammer minus a backward

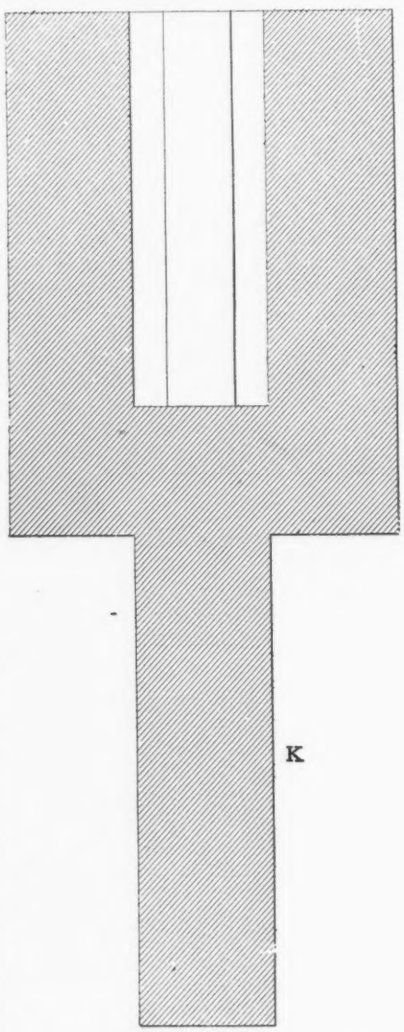


FIG. 4. SECTION OF FALSE CHUCK FOR AIR-HAMMER DRILLS

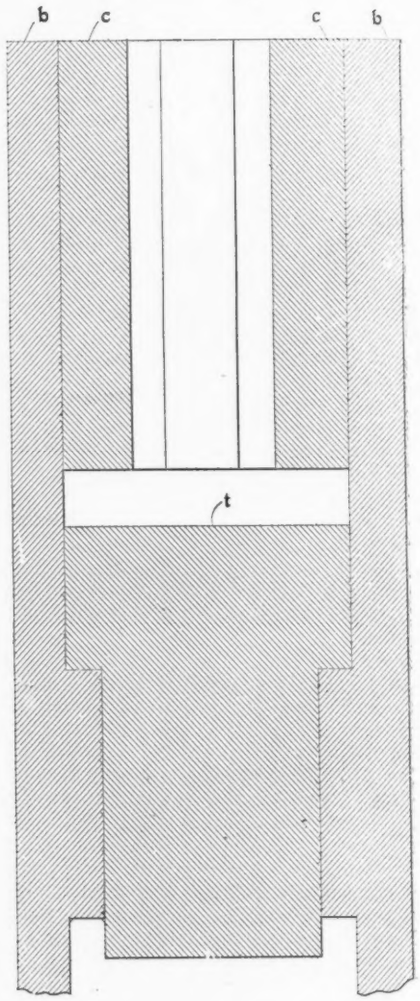


FIG. 5. SECTION OF STRIKING-PIN CHUCK FOR AIR-HAMMER DRILL

pressure upon the shoulder, *S*. As the hammer moves forward the ports, *P*, are closed by the ring, *R*, until the ring is passed, when they open to the exhaust *E;* the air pressure then is upon the shoulder *S* and moves the hammer back.

As regards the relative merits of the valve and valveless types I prefer not to express an opinion. With the valveless type it seems necessary to use a hollow

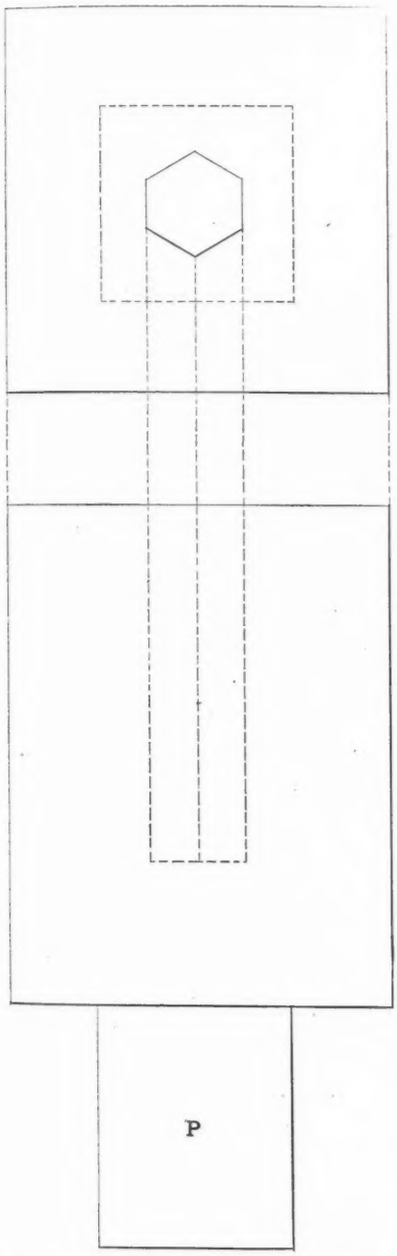


FIG. 6. TOOL FOR SHANKING AIR-HAMMER DRILL STEEL

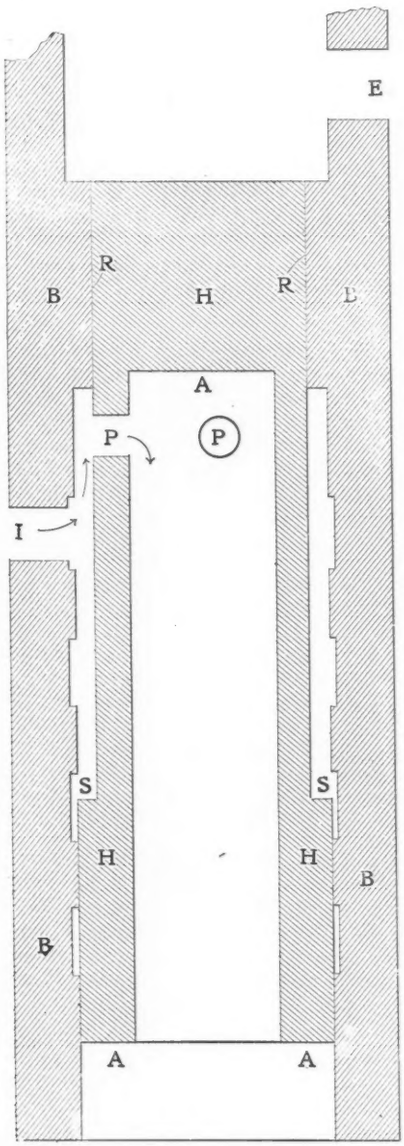


FIG. 7. SECTION OF CYLINDER, VALVELESS AIR-HAMMER DRILL

or partly hollow hammer which renders this part more liable to breakage, while with a valve a solid hammer may be used but another moving, breakable part is introduced into the machine.

ADVANTAGES AND DISADVANTAGES OF AIR-HAMMER DRILLS

In an article by J. T. Glidden in the JOURNAL Nov. 2, 1907, the statement is made that air-hammer drills are not adapted to the drilling of holes over 24 or perhaps 30 in. deep. The writer of that article has evidently had little experience with the later types of these machines. The average depth of hole drilled with these machines in the Cripple Creek district is greater than the average for a 2¼-in. piston drill. The depth of hole is limited in practice only by the length of steel that it is convenient to employ. The main drawback seems to be that air-hammer drills are not readily adapted to flat or down holes. For this kind of work it is necessary to use hollow steel with either air or water, or both, passing through it to clear the hole. If holes are drilled dry the amount of dust raised is sufficient to condemn the practice at once, while, if a water attachment is used, it is necessary to have water under pressure brought to the machine. For this purpose either a water pipe must be put in or a water tank used, the pressure being obtained through connection with the air pipe.

In driving drifts it is generally necessary to make a set-up; and thus is lost one of the great advantages obtained in overhead stoping. For these reasons the machine is not likely to replace piston machines for drifting or breasting. If they do replace piston machines for this kind of work they must show a considerably greater drilling efficiency in order to offset the disadvantages.

I have not had enough experience in this kind of work to speak with any authority upon this phase of the subject. For overhead work, however, I do not hesitate to say that a properly constructed air-hammer machine, with the hammer of the same size as the piston of the piston machine with which it is compared, will drill approximately double the footage per shift. Of course each machine is to use the same size bits. The character of the rock drilled does not affect this comparison except that wet sticky ground will be somewhat more favorable to the piston machine. In the Cripple Creek district the companies using air-hammer drills claim that in overhead drilling a saving of approximately 40 per cent. is made by using air-hammers instead of piston drills.

Zinc and Lead Mining in Tunis

While there has been no very notable increase in the shipments, the high prices of the metals during the first nine months of the year have already insured handsome profits to fortunate mine owners such as Djebel Ressas, Khanguet, Ben Amar, and Royal Asturienne, says a correspondent of the *Mining Journal.* Several new affairs with big tonnages blocked out have found ready purchasers. The Ressas company has purchased the mine of Koudiat Sidi, near Kef. A Belgian company has made a fortunate acquisition in the lead mine of Bazina, in the Nefsa district, and the mine of Guern Alfaya, a very fine calamine mine, has just passed into the hands of a Paris group. The lead and zinc mines of Aïn Allega, purchased two years ago by the Mokta company, are developing an enormous quantity of ore, which requires, however, special treatment; a very costly dressing plant is in hand to deal with it.

A consular report from India says that if the tax on salt were removed and the Indian mines and salt waters were utilized, the price could easily be reduced one-half.

The Lemoine Diamond Scheme

Some particulars of the Lemoine diamond-making affair, which is now attracting so much attention in London and Paris, are given by the London correspondent of the New York *Sun*. It is no case of selling a gold brick to a hayseed. The alleged swindler, a French engineer named Lemoine, has been trying to sell the secret of how to make diamonds to Sir Julius Wernher, president of the De Beers Company.

The price was to be $20,000,000, and the South African magnate has already parted with $320,000 for building and experimental purposes. He now charges Lemoine with swindling him, and is suing him for the third part of the money advanced, admitting that he is willing to let the other two-thirds go as the price of his own credulity.

The Parisian public has taken the matter up in truly Parisian fashion. So complex has the inquiry become that the friends of M. le Poitevin, the *juge d'instruction* who has charge of the case, are already beginning to fear for his health. The newspapers, of course, have already taken sides, and Lemoinites and anti-Lemoinites discuss the affair with Gallic excitability.

Lemoine is a fairly tall, well set up man, who impresses the looker on as being quite out of the common run, whether or not he has discovered how to make diamonds. "A perfect man of the world, having an open face with regular features, a square black beard, and eyes shining with energy," is the description one spectator gives of the man who has persuaded many that he can make diamonds.

Lemoine gives the following account of his dealings with Sir Julius Wernher. He pretends to have perfected Moissan's method of making diamonds. Not having sufficient funds to pursue his work properly, he secured in 1904 an introduction to Wernher, who went to Paris three years ago to see some experiments. These were so successful that Wernher entered into a contract with him and supplied funds for the construction of a big workshop and the remuneration of the inventor, who received in all $400,000. Other contracts relative to the workshop and various details were subsequently signed, Sir Julius promising not to endeavor to fathom the secret.

The explanation of the secret, the formula of the now famous black powder, was placed in an envelop, which was then sealed and deposited in a safe at the Union Bank in London. The conflict just now is raging around this envelop. Sir Julius demands that it be produced, declaring that it will be found to contain only a blank sheet of paper. Lemoine's counsel, Maitre Labori, of Dreyfus trial fame, protests against the production of the envelop, as it would give away his client's secret with all its potentialities of wealth. If the envelop were in France the *juge d'instruction* would have the power to order its production. But the law is different in England, and it seems unlikely that the bank will deliver it to anyone without the consent of Lemoine.

The experiments which Lemoine performed for Sir Julius Wernher and which he has performed for others may best be described in the words of Lord Armstrong, one of the principals of the great Newcastle firm, who is a firm believer in the diamond maker. Lord Armstrong does not hedge at all; he says that he has been in Lemoine's laboratory in the Rue Lecourbe in Paris and is "fully satisfied that Lemoine has discovered the philosopher's stone."

"Like St. Thomas," Lord Armstrong proceeds, "I only believe in what I have seen and touched, and I have now the absolute conviction that M. Lemoine is a genius, and that what he asserts is correct. M. Lemoine handed me a powder, which in order to convince myself I worked up with my fingers. It was nothing but a powder. I myself put this powder into an empty crucible, which I closed again, and I personally put the crucible into the furnace. When under the instruction of M. Lemoine, who stood some distance from me and could in no way interfere in the operation, I withdrew the crucible, I found in it an agglomerated mass, which I allowed to cool before my eyes. I myself broke this shapeless mass, which presented the appearance of carbonized matter, and there I found these pure diamonds and these other diamonds less perfect."

Lord Armstrong brought out of his safe an envelop from which some little brilliants slipped and scintillated in the sunlight. These are diamonds of the purest water. An expert has valued them at £1 per carat.

Lemoine at present offers to renew his diamond-making experiments in the presence of fresh experts, but only on condition that he be released on bail. But Sir Julius Wernher opposes bail being granted, and the magistrate supports him. Lemoine therefore makes a fresh challenge in these terms:

"I undertake to sell all my goods and chattels and property whatsoever and to deposit the proceeds in a bank chosen by Sir Julius. I will add thereto 500,000 francs of shares in my electric factory at Argelès in the Pyrenees and 150,000 francs more of shares in another concern here which I have floated with Mr. Jackson, who represents a rival undertaking to the De Beers.

"All this shall be held as bail by Sir Julius Wernher, who must then agree to my release, when I will renew my experiments. If these succeed Sir Julius shall return me my surety, plus damages to compensate me for the publication of my secret, the sum to be fixed by the courts. If I fail Sir Julius will, *ipso facto*, enter into possession of everything I have in the world, and furthermore he will be free to sue me for damages."

Sir Julius refuses to do anything more than deposit $80,000, which Lemoine may have for his secret. Sir Julius declares that when he entered into his contracts with Lemoine the experiments he had witnessed seemed conclusive and above all suspicion. As governor of one of the most important diamond-mining companies he could not help taking an interest in a discovery which might have an important bearing on the diamond market.

His idea, he says was to sacrifice a comparatively small sum, for him, in order to see whether Lemoine's process could have any damaging effect on the production of natural diamonds. His contract stipulated that all the artificially produced diamonds were to be handed over to him. He never had any idea of placing them on the market.

It was some time before he had any suspicions of Lemoine. But when the latter failed to deliver any more diamonds, but continued to ask for more money, Sir Julius apparently began to have suspicions. He had an expert named Hoats over from the Cape. The day the expert attended the experiments, which had been perfectly successful when performed before Wernher and his friends, entirely failed. Lemoine blamed the electric supply, which he said was too low, but obstinately refused to perform any more experiments in the presence of Hoats. Sir Julius then appears to have been convinced that he had been hoaxed.

Coal Mining in Alsace-Lorraine

Consul William J. Pike, writing from Kehl, says that within a period of six years the coal output of Lorraine has increased by 1,000,000 tons, or doubled itself. The production in 1906 was 2,115,363 tons, in which 9775 men were employed. One new company has been formed, and the three present operating concerns are planning extensions of their works.

Experimental boring in different parts of Lorraine reveals that there are still a great number of coalfields to be worked, and as several large commercial companies are interested in the development of the coal industry it is anticipated that several new mines will be opened up at an early date. The great difficulty which mine owners have to face at the present time is the scarcity of men. Lorraine already occupies a very high position as a coal producing country, but if the present rate of progression continues it will head the list in the west of Germany.

Consolidated Gold Fields of South Africa, Ltd.

Notes on the Last Report of This Company. The Efforts to Reduce Working Expenses, Both at the Mines and the Mills

BY EUSTACE M. WESTON*

In this report the consulting engineer and superintendents of the company state that labor conditions for the year were much improved owing to the increasing efficiency of the Chinese coolies employed ; but, notwithstanding the present supply of native labor, the effect of the repatriation of so many trained workers is viewed with anxiety. The work of the Chinese at the Simmer & Jack mine crushed per stamp per day, 5.41; average working cost per ton, 23s. 0.99d.; profit, £145,052.

The following figures, taken from the annual reports for the years indicated, show the conditions when Chinese have been used underground. In 1905, stamps running, 275; in 1906, 320; in 1907, 320. Total tons milled in 1905, 526,541; in 1906, 637,757; in 1907, 726,654. Tons milled per stamp per day in 1905, 5.42; in 1906, 5.66; in 1907, 6.45. Average cost per ton in 1905, 22s. 8.15d.; in 1906, 20s. 0.47d.; in 1907, 18s. 4.74d. Total working profit for 1905, £244,004; for 1906, £375,281; for 1907, £500,101.

The increased supply of natives now available is largely due to the stoppage of public works in the neighboring colonies and to the slump in the diamond market. It is stated that the De Beers company at Kimberly has discharged 10,000 natives; 3000 of these were secured for work at the Simmer & Jack to replace the first lot of Chinese repatriated. But, as the engineers of this company point out, the supply of native labor is always fluctuating and there is no reason for hoping that it will be found sufficient to replace the 40,000 Chinese still remaining and also provide for opening up new mines like the Simmer Deep and Jupiter that will shortly begin crushing.

Advantage has been taken of the recent strike to introduce a scheme for training efficient machinemen, of whom there has always been a scarcity on this field.

WHITE MAN AND CHINESE CREW OPERATING AIR-DRILL ON THE RAND

The coolies soon become expert, and one white man oversees the operation of two or three drills. The gold-bearing banket is shown behind the candle.

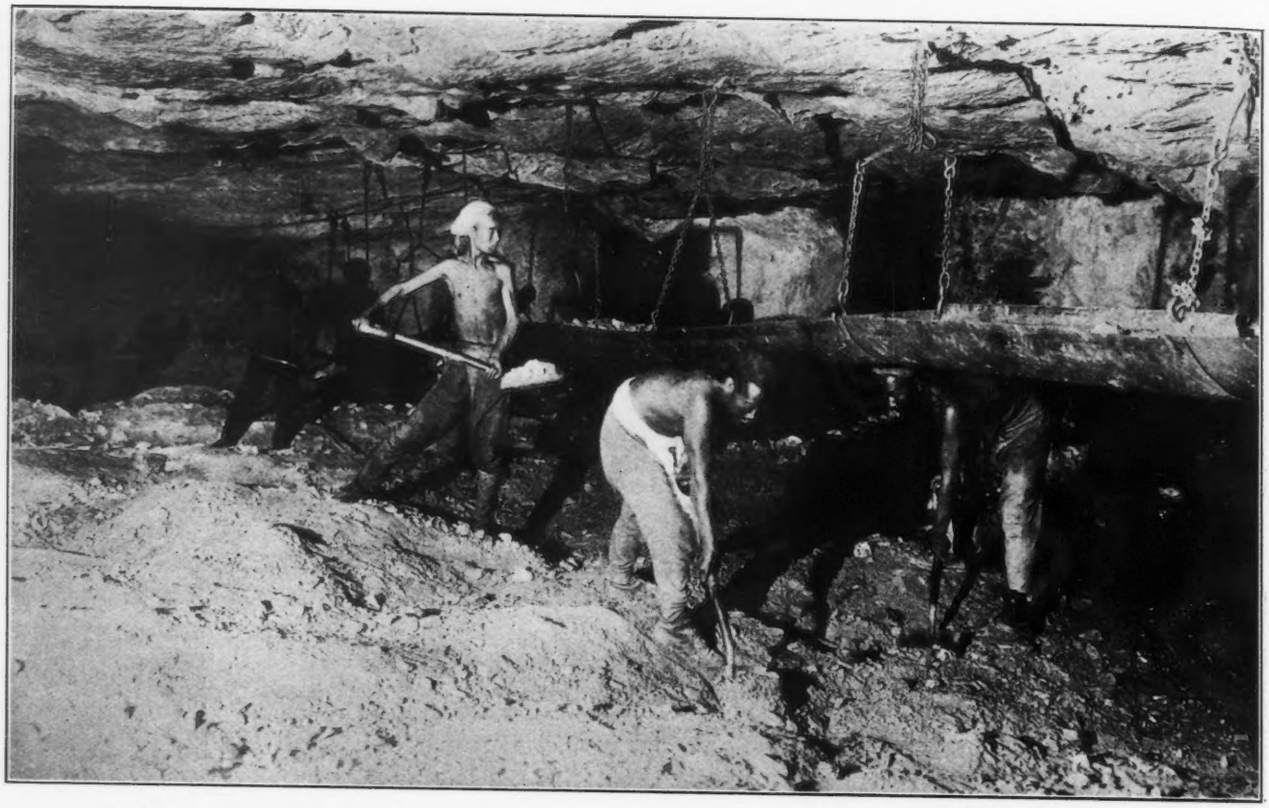
"shows conclusively the superiority of Chinese over any other class of unskilled labor that has been employed."

This statement is borne out by the study of former annual reports of this company. The following figures taken from the report for the year ending Aug. 31, 1904, show the conditions when Kafirs were used underground: Average stamps running, 165; tons milled, 318,692; tons

Necessity for Lowering Costs

The importance of lowering costs is emphasized in this report by calling attention to the large tonnage, at present

*Manager, Rand Collieries, Ltd. (Gold Section), Brakpan, South Africa.



CHINESE COOLIES SHOVELING INTO A SHAKING CONVEYER IN A REEF, ABOUT 8 FT. WIDE, ON THE RAND

CHINESE COOLIES SINGLE-JACKING IN A WIDE STOPE ON THE RAND

too low-grade to pay for extraction, that could be rendered profitable. There are several million tons of such "ore" already developed in the mines of this group and it has been estimated that on the central Rand there are already developed about 80,000,000 tons of ore assaying less than 4 dwt. per ton. To work such ore, an efficient unskilled labor supply must be available. But owing to short contracts of service and a deficient supply of natives, causing competition for their services, it has been hard to devise any system of piece work that much improves their efficiency.

It is hoped to increase the range of use of rock drills underground and this report comments as follows on this subject: "The minimum width for stopes that can be profitably attacked by existing large machines is dependent upon the conditions in each mine. Where the reef exceeds this minimum width, machine stoping usually shows a slight *pro rata* gain over hand stoping. On this group 60.9 per cent. of the rock mined was broken by machines. In the case of the 39.1 per cent., mined from narrow reefs, it is a difficult matter to displace hand labor economically."

The extra speed attained renders development by machines cheaper than by hand labor. The industry requires a small stoping drill, "whose essential features are efficiency in very hard rock and low maintenance costs." Various trials have been made of small stoping drills at the mines of this group; but so far none of these has met local requirements but the company it still experimenting with several other small air drills.

Improvements in Stamp Milling.

In the construction of the new 300-stamp mill for the Simmer Deep, H. C. Behr is introducing several innovations to reduce the first cost of the mill and to facilitate greatly its subsequent operation. The bin framing and roof trusses will be of steel but the battery framing, bin lining, floors and the wall framing will be made of timber. This composite structure of steel and wood should be cheaper than the old type and the danger from fire will be diminished. A saving will also be effected by the elimination of the cast-iron anvil blocks on which the mortar-boxes formerly rested, for the new plant has been designed with the mortars resting directly upon the concrete. The new stamps will be the heaviest yet installed on the Rand, as they weigh 1670 lb., and they should give an output of 8 tons per stamp per day. The capacity of this 300-stamp mill will thus equal that of a 400-stamp mill of average design. The mortars are being made wide enough so that the weight of the stamps can be increased to 1800 lb. if it is found desirable.

The whole mill will be operated by electric-power purchased from the Victoria Falls Power Company. The stamps will be in units of 10, each unit being driven by a separate motor.

Several improvements have been made during the year at the Robinson Deep. All the 300 stamps and the two tube-mills are running. The average residues assayed 0.456 dwt. per ton during the past three months and a recovery of 95.136 per cent. was made.

The Luipaardsvlei Company crushed 8.27 tons per stamp per day with an extraction of 92.54 per cent.

The Consolidated Gold Fields of South Africa, Ltd., has built a testing laboratory. This has been kept busy testing supplies for the mine and mill and the standard of the goods, furnished by manufacturers to the company, has been greatly improved.

Leasing of Coal Lands Urged

Secretary Garfield of the Interior Department, in his annual report made public Feb. 3, discusses at length the question of the coal lands belonging to the Government, and urges some radical changes in the laws governing their disposition. He estimates that approximately 70,000,000 acres in the Western States are underlaid with coal. About 66,900,000 acres have been withdrawn from entry for the purpose of determining whether or not they are underlaid with coal, this action being taken because, the report says, it was found that serious frauds were being perpetrated in the acquisition of coal lands. Under the existing law, Mr. Garfield points out, no individual can purchase more than 160 acres, nor can an association or corporation purchase more than 320 acres, which in a majority of instances is not enough for mining purposes. In advocating a law by which the Government could lease such lands, the secretary says:

"I cannot urge too strongly the need of a change in the policy hitherto adopted by the Government for the disposition of the coal land. The coal remaining in the public domain should be so used as to induce its development in accordance with the needs of the country, but at the same time to prevent waste or monopolization in the hands of a few. In order to accomplish these purposes the man or the corporation producing the coal must be given an area sufficiently large to warrant the expenditure of the money necessary to profitably develop and market the coal. The experience in other sections of our country and abroad leads me to believe that the best possible method of accomplishing these results is for the Government to retain the title to the coal and to lease under proper regulations which will induce development when needed, prevent waste, and prevent monopoly. Such a method permits the separation of the surface from the coal and the unhampered use of the surface for purposes to which it may be adapted. The surest way to avoid the evils of monopolistic control by private interests is to retain in the Government the right to control operation under lessee regulations."

The Andrew Carnegie Research Scholarship

A research scholarship or scholarships, of such value as may appear expedient to the Council of the Iron and Steel Institute from time to time, founded by Andrew Carnegie (past-president), will be awarded annually, irrespective of sex or nationality, on the recommendation of the Council of the Institute. Candidates, who must be under 35 years of age, must apply on a special form before the end of February to the secretary of the Institute.

The object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works, provided it be properly equipped for the prosecution of metallurgical investigations.

The appointment to a scholarship shall be for one year, but the Council may at their discretion renew the scholarship for a further period instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a paper to be submitted to the annual general meeting of members, and if the Council consider the paper to be of sufficient merit, the Andrew Carnegie gold medal shall be awarded to its author. Should the paper in any year not be of sufficient merit, the medal will not be awarded in that year.

Application should be made to Bennett H. Brough, secretary, at the office of the Iron and Steel Institute, 28 Victoria street, London, England.

There are two methods of refining crude oil in common use. In the non-continuous system the distillate is turned from one storage cylinder to another, when the distillate reaches the specific gravity, limiting that grade of oil. In the continuous process the oil flows through a series of stills. The temperature of each of these is so regulated as to distill off certain grades of oil. The residum flows, when it reaches a certain specific gravity, to the next still, where a higher temperature is maintained, and the process is continued.

New Railway Construction in the Southwest

By Dwight E. Woodbridge*

Some very important railway construction is either under way, or is to begin when general financial conditions warrant, in the Territories of Arizona and New Mexico. These have an especial bearing on the mining situation in the Southwest.

The main line of the Southern Pacific now runs across Arizona from Steins Pass to Yuma, but it is an expensive line to operate on account of crookedness and severe grades. No less than four summits of considerable altitude must be overcome in this distance; three of these, the Chiricahua, Dragoon, Rincon and Maricopa, are in the eastern part of the Territory; the Mohawk summit is in the western part. Some of these summits are severe with very bad grades between, especially the grade in and out of the San Pedro river. By passing up the San Simon plain, along the line of the Gila Valley, Globe & Northern, then westerly down the Gila valley and through its cañons at the south end of the Pinals, continuing on by the Phoenix & Eastern through Phoenix, the territorial capital, to a junction with the main line near Gila Bend, the road can avoid all these summits; besides, this route passes through a better country and would be no longer than the present route.

With this change in mind the Southern Pacific management has been making permanent improvements on the Gila Valley, Globe & Northern, especially as far north as San Carlos, where it crosses the Gila; it has secured possession of the Phoenix & Eastern from the Santa Fe, which runs from Tempe to Winkelman, and to within 30 miles of San Carlos on the Gila Valley line. It owns from Tempe to Phoenix; so that, to carry out this change of route, it has merely to construct the gap between San Carlos and Winkelman and that between Phoenix and Gila Bend.

The other great transcontinental line across the southern part of the United States is that known as the Santa Fe System. This route now climbs and twists on its way east through Mojave and Yavapai counties in the most excruciating manner. It is all up-grade from the crossing of the Colorado river to Flagstaff, where it drops down the other side of the divide. There is no water for 50 to 60 miles either side of Peach Springs. The company has built a line westerly from the Santa Fe, Prescott & Phoenix near where that railroad crosses the Hassayampa, to the Colorado, passing almost direct through the Harrisburg camp, skirting the Harcuvar mountains and crossing the Colorado north of the Indian reservation and near the mouth of Bill Williams Fork. From there the line will run west through San Bernardino county, Cal., connecting with the present main line south of the big bend. This road will connect with the main line to the east of Phoenix, either by way of the Albuquerque branch and then by the way of Silver City, or across the Mogollon mesa. Thus both of these important transcontinental roads will pass through the south central part of the Territory.

*Mining engineer, Duluth, Minn.

New Construction

Both these transcontinental roads are constructing branch roads, chiefly to aid in the development of the mining resources of the region. The Southern Pacific is now operating the Arizona & Colorado from Cochise to Pearce, a distance of about 19 miles. This branch is expected to become an important road, for it will extend southerly through the Sulphur Springs valley to Douglas, Bisbee and Naco, and north from Cochise through Graham county and, by the Gila Valley line, into New Mexico and on to Durango, Colo. The plan is to make this route the key to an important source of coal and coke for the Southwest. At Naco it will connect with the Cananea line and the works of the Greene-Cananea company; at Douglas it will connect with the Southern Pacific's proposed road, which is to be extended by way of Nacosari and down the Yaqui valley, to connect with its Mexico City line west of Guaymas, the connection being made probably near Tonichi, Sonora. This will be a favorite road for prospectors, as the Rio Yaqui is full of indications of mineral.

There is under construction a line from Cananea northwesterly to Nogales, through Santa Cruz and Casas Viejas, about 50 miles in length. This line should open a good mineral region.

In all probability a line will be built from Calabasas, about ten miles north of Nogales, to Tucson, in which case the road, belonging to the Twin Buttes Mining Company, would probably be absorbed and in part utilized. This independent line now runs south and southwest from Tucson to the Twin Buttes camp, for the accommodation of the mining company of that name. About 35 miles of easy work up the Santa Cruz river would be required. The district has considerable mineral possibilities, now unappreciated on account of transportation difficulties and various grants.

The Southern Pacific is now considering the construction of a line up the San Pedro river from Dudleyville south about 20 miles to the Mammoth camp, where extensive copper developments are in progress, which promise much in the course of time. At Dudleyville this line will connect with its Phoenix & Eastern. A branch road will be built from this latter road also to the Superior and Silver King districts, where development, though just now impeded, is sure to be extensive in time, for the indications of mineral are excellent.

The Santa Fe is now building its Silver City road into the heart of the Burro mountains, and will pass near all the shafts opened on any important scale in that camp. It has recently completed and put into service the Belen cutoff across a part of New Mexico, greatly shortening the road and improving the grades, but not bettering the opportunities of the prospector to any considerable extent, except as any road through a generally mineral region may benefit prospectors.

The El Paso & Southwestern has done, and is still carrying forward, considerable work. It has shortened its connections with the coal and coke fields of northern New Mexico. The Northwestern, both in maintenance of way and water supply, has been improved until its old owners would not know it; some building has been done into Sonora from Nacosari; considerable equipment of the most modern, effective and powerful character has been added to this system.

Passing to the realms of possibility, there is the Spreckles line from San Diego eastward; this is being surveyed through southern California toward the Colorado river and it is said that it will finally connect with some present road that will take it at least as far east as El Paso. There is also the Southern Pacific concession up the coast of Sonora through the Altar district from Guaymas to Yuma; that in time may perhaps be more than a concession.

The Canadian Mining Institute

The tenth annual meeting of the Canadian Mining Institute will be held in Ottawa, March 4, 5 and 6. The meeting will be opened on Wednesday morning, March 4, by an address from the Governor-General of Canada. The business meetings will be held on that day, while the sessions on Thursday and Friday will be devoted to reading of papers and discussion. The annual dinner will be held on Friday evening.

Several amendments to the by-laws will be brought up for consideration, including one giving the election of secretary and treasurer to the council, instead of the members of the institute; and one authorizing the transfer of the permanent headquarters from Montreal to Ottawa.

According to C. V. Slocum, in a paper before the Pittsburg Foundrymen's Association, tests on bars, measuring 1 in. square by 12 in. between supports, show that the transverse strength of a strong mixture, averaging about 3000 lb. breaking strain, was increased to 3600 lb., or 20 per cent., by using only half of 1 per cent. of an alloy which contained 10 per cent. titanium.

The Sweetland Filter Press

By Ernest J. Sweetland.

The filter press here described embodies several special features designed to render every part accessible, and at the same time to avoid having any moving parts in the working of the machine. Referring to Fig. 1, which is a side elevation of the filter with a portion shown in section; the main body of the machine, which forms the filtering chamber, is of laminated construction, comprising a series of cast-iron frames supported upon a pair of side rods. Cemented to one side of each frame is a special rubber gasket, so arranged that when the heads are in place and all held tightly together by the pressure screws, a water-tight chamber is formed.

The shape of the frames is shown in Figs. 2 and 3 in which portions are shown in section to illustrate the connections. As these frames differ in their purpose they will be designated as *A*-frames and *B*-frames for purposes of explanation.

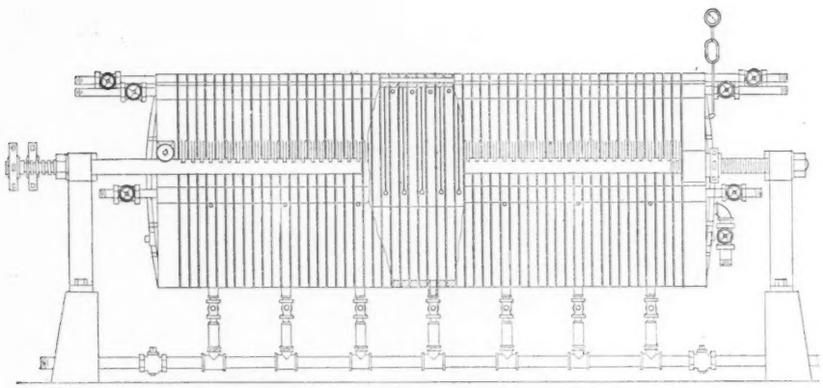


FIG. 1. SIDE ELEVATION, SWEETLAND FILTER PRESS

The filter mats are carried by the *A*-frames and each consists of two layers of cocoa matting inclosed in an envelop of 15-oz. duck. Along the lower edge is a flattened perforated pipe which conducts the filtrate through the union and nipple into the opening in the frame. A small duct in these frames leads from the interior of the filter-mat connection to a pet-cock on the outside of the frame. The object of this is to provide separate communication with each filter mat, so that, if at any time a leak should occur, the faulty filter may be located by taking a sample from each one separately.

Both types of frames have a number of corresponding openings, one at the top and two on each side. When the frames are clamped in position these openings form a series of conduits the entire length of the machine, terminating in pipe connections at the ends. The lower conduits serve as drains for the filtered liquid.

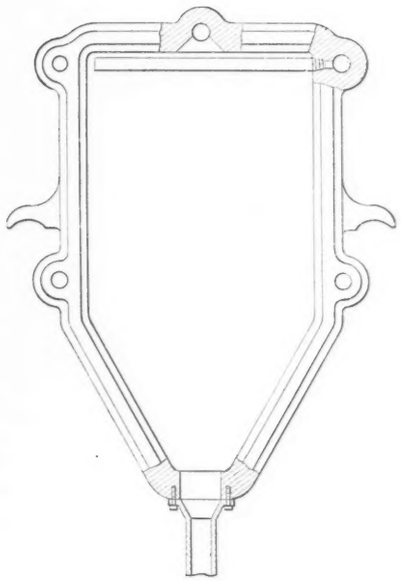


FIG. 2. *A* FRAME

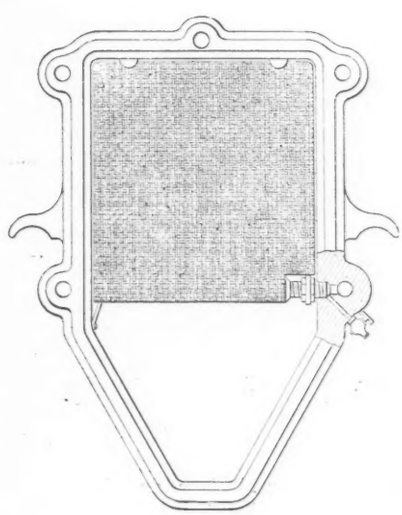


FIG. 3. *B* FRAME

The *B*-frames are provided with a flaring port connected with the uppermost conduit. At the end of this conduit is the pipe connection which leads to the sludge pump, and the sludge is caused to enter above and between the filter mats.

The perforated pipes shown in the *B*-frames are fed by the conduits at the two upper corners, and are used to wash down the filters when necessary. These are not used in the ordinary cycle of operations, but should the machine become blocked from over-charging and form thicker cakes than can be detached by reversing the pressure within the mats, these spray pipes are brought into use and clean all of the filters simultaneously.

The lower end of the *B*-frames have ports cast in them as shown. It is through ports that the residues are finally discharged in the form of mud, carrying about 60 per cent. solid matter.

Method of Operation.

The sludge is admitted under pressure into the chamber through the flaring ports at the top of the *B*-frames. As soon as the air is expelled filtration commences, and in from 10 to 15 minutes a cake 1½ to 2 in. in thickness is formed on the surface of the filter mats.

The next step is to empty the chamber and fill with wash solution or water. In order to prevent any of the cakes falling off during this operation a vacuum of about 5 in. is maintained within the filter mats while the change is taking place. The vacuum is automatically brought into effect when the filtrate valves are closed. When the chamber is filled with wash solution (which enters through the bottom ports) the air vent is closed and the cakes are washed until the cyanide and dissolved values are displaced.

The residues are then ready to be discharged. The first step in discharging is to drop the cakes to the lower portion of the chamber. This is done by admitting water or air pressure to the interior of the filter mats while the chamber is still filled with wash water. The cakes drop to the bottom carrying about 40 per cent. moisture, and this residual mud is of such consistency that it is easily forced through a 4-in. pipe line 100 ft. long with a pressure of 20 lb. per square inch.

Rapidity of Operation.

In a machine of this type installed in Goldfield the time required for a cycle of operations, a 1½-in. cake being formed and discharged, was as follows: filling with sludge, 3 min.; forming cakes, 10 min.; running back sludge, 2½ min.; running in wash water, 2½ min.; washing, 10 min.; discharging, 10 min.; total 38 minutes. The maximum pressure while forming the cakes was 60 lb. per square inch; during the washing of the

cakes the pressure rose to 65 lb. The moisture in the discharged residues was 42½ per cent.

The following titrations of the wash water show that the liquid passed through the cakes uniformly, the percentage of cyanide dropping suddenly after six minutes washing:

In titrations of the wash-water after 10 successive minutes, the following percentages of cyanide were found: 0.15; 0.15; 0.14; 0.14; 0.13; 0.13; 0.04; 0.03; 0.01; trace.

Canadian Graphite

By H. Mortimer Lamb*

The third of a series of useful and valuable monographs on the economic minerals of Canada, has just been issued by the mines branch of the Department of Mines, under the direction of Dr. Eugene Haanel. Former reports dealt with mica and asbestos; the present treats comprehensively of graphite, its properties, occurrence, refining and uses. The utility of these monographs is twofold. They are of value to those who are engaged or who propose to engage in the industries reviewed; and they unquestionably serve to advertise, by a means wholly adequate and trustworthy, the resources of the country.

The task of compiling this report was intrusted to Fritz Cirkel, of Montreal, who was also the author of the two preceding monographs. The work contains in well digested form a large body of information relating to the industry in all countries in which graphite is produced, while the geological occurrence of the mineral, both in Canada and elsewhere, the origin of graphite, composition of ores, and methods of mining, dressing and refining, are among the subjects specifically discussed. In his introduction the author refers to the difficulties he encountered in assembling facts in order to present an intelligent review of the world's graphite industry since the literature on the subject is not only meager but not readily available.

Occurrences in Canada

As is well known, the bulk of the world's supply is derived from Ceylon, Austria and the United States, in comparison with which countries Canada's production appears somewhat inconsiderable. As a matter of fact, while the mining of graphite in Canada dates back to 1847, it is only quite recetly that endeavor in this direction has met with any notable success, as a result chiefly of improvements in milling methods. The distribution of the mineral, however, is wide; it is found in no less than five of the Provinces of Canada—Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia. In a paper read before the Canadian Mining Institute (Transactions, C. M. I., Vol. X, 1907) H. P. H. Brumell divides the mineral, for commercial purposes, into three groups, anthracite, amorphous and crystalline, the last being again divided into "vein" and "disseminated" ores. According to this authority a comparatively large deposit of the anthracite variety occurs near Lepreau Harbor, on the Bay of Fundy, N. B., while the amorphous is found at a number of points in Nova Scotia, New Brunswick and Ontario. The crystalline, which is the most important, occurs in commercial quantities largely in the Archæan rocks to the north of the Ottawa river, and also to a smaller extent in these rocks in eastern Ontario. Mr. Cirkel, in his report, states, in agreement with Mr. Brumell, that most of the workable deposits are of the disseminated class, and that while fissure veins occur abundantly throughout the Laurentian formation, the best returns have always been obtained in cases where the mineral is found disseminated in the form of fine scales or flakes accompanied occasionally by irregular pockets or bunches of amorphous graphite. The more important deposits are situated in the townships of Buckingham, Lochaber and Grenville, in the Province of Quebec; in the counties of Lanark, Leeds, Frontenac and Addington, in the Province of Ontario; in the vicinity of St. John, and in Kings and Westmoreland counties in the Province of New Brunswick; in the Province of Nova Scotia, on the island of Cape Breton, at Glenvale and elsewhere; while many years ago a discovery of graphite, of good quality, was reported by the Geological Survey, at Alkow Harbor, Dean Canal, British Columbia.

The Quebec Deposits

Referring to the Quebec deposits it may be broadly stated that they are confined to rocks of pre-Cambrian age, the mineral being found usually in the Grenville series, or upper beds of the Laurentian system—crystalline limestones and associated gneisses. These rocks are cut frequently by intrusive dikes of granite, diabase, pyroxene, etc., and the graphite occurs in the form of disseminated flakes or scales, in gneiss and limestone, or as true veins, both columnar and foliated, which, however, are also found frequently cutting the granite and other igneous rocks as well as the gneiss.

The principal mines in operation in this Province are those of the Anglo-Canadian Graphite Syndicate, the Buckingham Company, the Buckingham Graphite Company, the Diamond Graphite Company, the Bell mines (which, however, are not mentioned in the report), in the vicinity of Buckingham, and those of the Calumet Graphite Company, in the Grenville district. In addition there are numerous promising locations on which development is in progress. The Anglo-Canadian Syndicate is at present in liquidation, but the property is equipped with a mill designed for the dry process, supplemented by wet treatment for the tailings by means of Brumell patent wet boxes. A considerable amount of development work has been done on this property with satisfactory results. The capacity of the mill is about five tons of finished graphite per week, the product being divisible into 10 grades, from a fine crucible and lubricating graphite to cheaper and coarser grades. The Buckingham Company's properties comprise what were formerly known as the Pugh and Wearts mines. The two chief openings are pits Nos. 6 and 7. In the first the occurrence of graphite, mostly of the disseminated variety, is very irregular, showing small veins of graphite from several inches to 4 ft. in thickness. In pit No. 7, measuring 60 by from 25 to 40 ft., the disseminated ore occurs in a band from 2 to 3 ft. wide. The process of refining formerly in use here was dry throughout, the ore being first roasted to drive off the moisture and sulphur and also to render it easier to crush; afterward it was passed through a system of rolls and screws. The Buckingham Graphite Company's mine is the largest in the district, the property comprising 1388 acres of graphite lands. Development has been carried on by means of pits and tunnels, there being in all some 30 openings, showing in a more or less degree the abundant presence of the mineral. Treatment is conducted by the Brumell process, the capacity of the plant being two tons of finished graphite per day. At the Diamond Graphite Company's mine a mill has been erected to treat the ore by a process devised by the International Dry Concentrator Company, of New York, whereby the ore is conveyed to stationary calcining furnaces, where the sulphur is eliminated, and then passed through crushers and rolls; after screening it is delivered to Krom air jigs, where the separation of the flakes from the gangue is effected. Graphite of a very superior quality has been produced from the Calumet Company's mine, which has now been equipped with a mill designed to treat 50 tons of rock a day. A new departure in this mill is the introduction of tube mills for cleaning and polishing the graphite flakes.

Commenting on the Quebec deposits, Mr. Cirkel thus summarizes: "The graphite in both the Buckingham and Grenville districts appears to occur in vein fillings, and is therefore younger than the containing formation, and in a disseminated form through the country rock. The veins generally traverse the latter in all directions independent of the strike, but a majority of them have a northeast direction. Graphite constitutes in most veins the only filling; in others, pyroxene, green apatite, scapolite, titnite and wollastonite are associated with the

*Secretary, Canadian Mining Institute, Montreal, Canada.

mineral. The country rock has been impregnated from these veins with graphite, and where the same is composed of crystalline limestone, the latter appears to be most susceptible to this influence on account of its loose structure. If the country rock is gneiss, this impregnation has been confined essentially to the layers richest in mica, along which also the rock breaks most easily. On the contacts of the graphite veins the neighboring rocks have been changed into scapolite and pyroxene, as is characteristic in the case of apatite veins. From an economic standpoint the disseminated graphite is the more important, since it occurs in larger workable deposits, and compared with the vein graphite gives far steadier returns. In the early days of graphite mining, chief attention was paid to graphite occurring in these veins, as it was naturally purer and more concentrated. Today all the larger mines obtain their principal output from disseminated orebodies, to the discovery and development of which attention is now mainly directed.

Ontario Deposits

In the Province of Ontario, the only important producing mines are those at North Elmsley, and the Black Donald mine, owned by Rinaldo McConnel, of Ottawa. In the former the dry process is employed, the present capacity of the mill being 10 tons of ore in 10 hours, giving, it is claimed an extraction of 10 per cent.; while at the Black Donald the wet process is in use. Here the mill equipment consists of a powerful Blake crusher, a 10-stamp battery and two buddles, 16 ft. diameter by 2½ ft. deep. The graphite having passed through the wet treatment, is conveyed to a dryer and thence elevated to bins above the top floor, being afterward sized in a long series of trommels. The different grades of the flake graphite are then subjected to grinding by buhrstones, producing a material valuable for lubricants and foundry facings. The Elmsley deposits occur in rocks similar to those of the Grenville series, while the general occurrence closely resembles the deposits of the Buckingham district. At the Black Donald, however, the ore occurs in a vertical vein traversing crystalline limestone and is composed mainly of amorphous graphite; the flake variety is nevertheless found in small stringers and pockets, as well as in the schistose walls. The total carbon content amounts to about 65 per cent., of which about 45 per cent. is amorphous and 20 per cent. flake. The vein is usually uniform from wall to wall, and has a nearly uniform graphite content. The graphite in the walls, however, gradually decreases as the more solid country rock is reached, and when the rock contains less than 15 per cent. carbon it is not mined. Owing to the similarity in the specific gravity and the size of the flake graphite, it is difficult to separate the two in the process of concentration. Hence, those portions of the deposit carrying chlorite are sorted out, together with the richer portions of the amorphous graphite, to form a product containing not less than 50 per cent. carbon, which is shipped in lump form for foundry facing purposes.

New Brunswick Graphite

Of the New Brunswick deposits special mention is made of that near the city of St. John, which the author recommends as worthy of exploitation. Note is also taken of a promising discovery in the neighborhood of a whaling station called Black Lead, in Cumberland Sound, on the north of Hudson strait, reported by the Geological Survey in 1898.

Origin of Graphite

In a chapter devoted to the origin of graphite, reference is made to the disseminated form of graphite through the limestones of Canada, which, it is suggested, owes its derivation to carbon originally present in the rock, probably of organic origin; by the same process of metamorphism, by which the limestone was converted into marble, this graphite has also been formed.

The purest Canadian graphite has invariably been extracted from veins, and this, if properly hand-sorted, need not generally be subjected to mechanical refining; for example, carbon as high as 99.815 per cent. has been found in some of the natural vein graphite at Buckingham. As previously stated, however, the bulk of the production is derived from the disseminated or flake variety, the ore of which carries but a small percentage of graphite. As a rule an economically valuable ore should not fall below 5 per cent., though as low as 3 per cent. has been worked. Most of the disseminated ores, mined in Canada, may be said to vary from 7 to 30 per cent. In the case of amorphous ores, the difficulties of concentration are so great, and the loss so heavy, that it is questioned whether an ore of this character containing 30 per cent. of graphite would pay to work.

Quality of Canadian Graphite

Compared with the product of other countries, Canadian graphite has been proved to stand very high, and in a series of tests carried out by Professor Hoffman, of the Geological Survey, to ascertain the relative value of Canadian and Ceylon graphite in respect to combustibility, the conclusion was reached that the Canadian product might claim equality with that of Ceylon, and is nowise inferior to the latter as a material for the manufacture of crucibles. As a further proof of the excellence of Canadian graphite for crucible manufacture, the report also alludes to the fact that recently 65 tons of flake ore from the Calumet mines were sent to Jersey City, and the finished product, some 30 odd tons, sold to some of the largest crucible makers in the United States, England and Germany, who pronounced it equal to the best Ceylon graphite, while to test its value for pencil manufacturing Mr. Cirkel made a number of experiments with different classes of ore, containing carbon varying between 85 and 97 per cent., at a large pencil factory in Nuremburg, Germany, which showed that certain varieties, on account of their fine crystallization, produce pencils which compare very favorably with those of good grade made from Bavarian graphite.

Statistics

In addition to the matters thus briefly referred to as contained in this valuable monograph, mention should be made to a large section devoted to statistical data and useful chapters on the dressing and refining and on the uses of graphite. In respect to the former the author, however, frankly admits incompleteness, explaining that operators in many instances are disinclined to afford information on the subject, and as in nearly every mill the methods employed are dissimilar, it is difficult, if not impossible, "to study the various mill schemes with the objects of generalizations." He has therefore confined himself to the enumeration and description of machinery for drying, crushing and concentration purposes, and has summarized the principles upon which the separation of graphite from the gangue is based.

The report is profusely illustrated with photographs and diagrams, and also contains a number of maps in color showing the distribution and occurrence of graphite in Canada.

The orebodies at Goldfield, Nevada, are considered by Frederick L. Ransome (*Economic Geology*, Oct.-Nov., 1907), to be a new type of ore deposit, that of alunitic and kaolinitic gold-quartz veins. The association of alunite, a hydrous silicate of potassium and aluminum, is considered by him to be of great importance. Mr. Ransome suggests the probability that the emanations from crystallizing magma are normally and initially acid but, by passage upward through the rocks, they become alkaline. If that is so, he suggests that ores such as those of Goldfield are deposited comparatively near to the source of the solutions. Mr. Ransome also suggests that further study will show that there are other ore deposit, besides those at Goldfield, that belong to this type; especially is this probable of gold veins in the tertiary volcanics; he suggests that another type of metasomatic veins will be found in the tertiary volcanics, where only the alunite is left.

Speed Regulation of High-head Water Wheels

By H. S. Knowlton*

At a recent meeting of the Society of Arts of the Massachusetts Institute of Technology, Henry E. Warren, superintendent of the Lombard Governor Company, of Ashland, Mass., presented a paper upon the governing of high-head water wheels. He showed that the utilization of water power where the fall is rapid involves not only the electrical transmission of energy to different points but also the construction of a different type of turbine, with special control mechanism, long penstocks to convey the water under pressure, speed-governing devices of extreme sensitiveness to take care of the rapid variations in the electrical load, and water relief apparatus to prevent damage by pressure waves in long supply pipes.

As the spouting velocity of the water varies directly as the square root of the head, the peripheral velocity of the turbine becomes high in high-head installations, tending toward economy in electric generators, of which the size and weight for equal output vary nearly inversely with the revolutions per minute. Impulse wheels, however, run at a considerably slower speed than reaction turbines of the same capacity, hence the gain in cost of generators and ease of governing through high kinetic energy of moving parts is not so great as the increased spouting velocity of the water would indicate.

Difficulties of Governing the Water Column

The great normal pressure of water in high-head plants requires careful engineering foresight to prevent trouble. Stress and deformation of the lower part of the pipe line with its valves and connections can be taken care of without difficulty, but the control of the water is a serious matter, especially by the use of gates. The gates are liable to be deformed and made to bind or rub; they then get out of balance, and leak. These objectionable features are not prohibitive, because governors are made powerful enough to move gates even though they bind and are out of balance, while leakage when the gates are closed may be checked by secondary gates in the penstocks of the wheels, or the wheels may be brought to rest by means of powerful friction brakes.

High-pressure reaction turbines require water passages that are very small in proportion to the output and accurate in contour. These small passages are easily clogged and must be supplied with clear water. Slight variations in the curvature of the passages are likely to produce great variations in efficiency. The surfaces must be smooth and free from abrupt changes in curvature and the material should be tough and homogeneous in order to resist erosion. The most difficult factor in regulating speed is the construction of a gate which will vary the power output at will without lessening efficiency. In spite of difficulties of this character reaction turbines have fundamental advantages over other types of water wheels in lower cost per unit of power.

*23 Richardson street, Newton, Mass.

Two Methods of Regulating

In discussing the principles of the Pelton wheel, it was brought out that in governing such wheels by deflection of the impelling stream, only slight force is required to deflect the nozzle because of the absence of friction or positive tendency to point in any particular direction. In the latest impulse wheels the vanes have been changed to double concave buckets finely polished, and designed to take the water which strikes them and turn it through an angle of about 180 deg. outward and backward, without causing interference or excessive commotion. The nozzle has been supported on trunnions to take the reaction of the jet without interfering with its deflection, and the curvature of the inner surface has been altered by experiment until the stream which issues is so free from eddies as to resemble a glass rod. By these means the efficiency of the impulse wheel when utilizing the entire stream from its nozzle has been made as good or better than that of the best reaction turbines. The output per unit of weight must, however, still remain at a great disadvantage when compared with that of the reaction turbine.

To avoid the great waste of energy when governing proceeds by deflection, wheels have been designed in which the jet of water is not deflected at all, the cross section of the stream being altered by means of a needle valve in the nozzle. This keeps the efficiency of the wheel high throughout the entire range of output, the only important objection being the element of great danger introduced by sudden variations in the velocity of the water in the long pipe line. The best types of impulse wheels are now furnished with combination deflecting nozzles with needle valves; the governor is usually designed to control the deflection, and some other means provided to produce slow movements of the needle valves. Ordinarily with this arrangement the needle valve which regulates the cross section of the jet is adjusted from time to time by hand as the maximum load varies, so that the governor in order to maintain constant speed is obliged most of the time to direct the stream almost, but not quite, squarely against the moving buckets. If the load increases so that the portion of the stream which is held in reserve by the governor is inadequate to maintain the speed during sudden peaks of the load, the cross section of the jet may be increased either by an attendant or automatically, by means of an electric motor. When a motor is used, control contacts are arranged to move the jet in a proper direction whenever the main nozzle is deflected away from a predetermined position by the governor. By these means the cross section of the jet will be maintained at a certain margin above that necessary to carry the average load. A device of this kind is better than manual control because of its unceasing vigilance; it is safe because the fastest travel which it can give to the needle valve will not create water hammer, and it is cheaper in operation.

A water-wheel governor must be able to exert great force, move quickly, and be sensitive to slight speed variations. Because the speed of the wheel cannot return to its normal value as quickly as the governor moves, the machine must act and then wait for the speed to return. The governor ought to be able to act when the water wheel is standing still, otherwise some other means must be used in starting. Governors are now in service which develop at their normal rating 50,000 lb. thrust at the piston rod. For speed of action the limit at present on small governors is somewhat less than one-half second for a complete stroke. The largest governors have a speed of from one to three seconds per stroke. It is possible to adjust the sensitiveness while the governor is in action. Variations within one-half of one per cent. cause prompt movements.

Inertia in the Water Columns

The speed regulation of high-pressure impulse wheels with deflecting nozzles is the easiest problem in governor engineering. A small regulator developing from 2500 to 7000 ft.lb. is powerful enough for the largest units. These governors should be of the oil-pressure type. Such machines may be wholly self-contained. The connections between the governor and the nozzle are simple and inexpensive, and the degree of speed regulation is about the same as with a steam engine. The problem of getting the best possible speed regulation from a high-pressure turbine or an impulse wheel with needle valve control at the end of a long pipe line is troublesome on account of the fact that the inertia of a long column of water cannot be changed with sufficient rapidity. A 5-ft. pipe line 5000 ft. long, with a maximum inflow of 8 ft. per second, and a head of 400 ft. gives theoretically an output of 5600 h.p. The actual weight of water in the pipe would be over 3000 tons, which exceeds that of a loaded freight train half a mile long. It would be a difficult matter to bring such a train from rest to a speed of 8 ft. per second or stop it from that speed within a second or two, yet this is just what some engineers expect can be done with an equivalent water column.

While it is impossible to determine the

actual initial rise of pressure caused by a sudden closing of the turbine gates, the matter is made even more complex by pressure waves, which, originating near the gate, travel back and forth through the water with the velocity of sound, setting the whole mass into vibration like an organ pipe. The stress may be greatest near the middle, and the need of a relief valve is apparent. The valves must move to the required position without oscillation in order to be effective, and must also open quickly. The time of closing must be long compared with the vibration pitch of the water column. The latter requirement is rather difficult with pipe lines several miles long. Special valves are now built which will open instantly and consume several minutes in closing, the speed of action being adjustable.

Though it is possible to prevent excessive rise in pressure due to reduction in velocity of long water columns, no means has been devised to produce quick acceleration of the water when, because of sudden increase of load, the speed of the turbine begins to fall. It may be several seconds before the water accelerates enough to supply the turbine's needs. Then the speed may be brought back on the other side of normal because of excessive gate opening. When the governor is made to act without oscillations which will encourage increased pressure vibration in the water column, the speed regulation will be poor if the load changes are sudden and large; it is impossible for this to be otherwise, because the water column cannot possibly alter the energy given to the wheel fast enough, whether the gates be in one position or another. The only complete remedy for the troubles in speed regulation caused by excessive inertia of a water column is some form of by-pass valve directly connected with the water-wheel gates, arranged to open as the gates close and thus keep the velocity of the column nearly constant. This involves a frequent waste of water equal to that required for the largest load variations, and cannot well be permitted in many installations. The compromise is to sacrifice part of the speed regulation for the sake of water economy. Frequently such stations are connected electrically with others where the hydraulic conditions are favorable to good speed regulation, which insures the even speed of the whole system with good efficiency.

Calculating Speed Regulation

An equation was developed for the predetermination of speed regulation, the quantities being as follows:

δ = percentage temporary change of speed.
g = acceleration due to gravity = 32.2 ft. per second.
T = time required for the governor to make a stroke.
$I = Wr^2$ = moment of inertia or flywheel effect of revolving parts.
S = normal speed in r.p.m.
p = h.p. output before the change in speed.
p_1 = h.p. output after the change in speed.

$$\delta = 81{,}000{,}000 \frac{T}{IS^2} (p - p_1).$$

Given an 8000-h.p. tangential wheel with deflecting nozzle and running at 400 r.p.m. driving a revolving field alternator. The flywheel effect of the revolving parts is estimated at 500,000 lb. at one foot radius. The speed of action of the governor is one second for a full stroke. Required, the percentage speed variation for (a) 100 per cent. (b) 50 per cent. and (c) 10 per cent. load change. Referring to the equation $T = 1$, $I = 500{,}000$ and $S = 400$.

(a) For 100 per cent. load change $(p - p_1) = 8000$.
(b) For 50 per cent. load change $(p - p_1) = 4000$.
(c) For 10 per cent. load change $(p - p_1) = 800$.

Substituting in the equation

(a) $$S = 81{,}000{,}000 \frac{1 \times 8000}{500{,}000 \times 400^2} = 8.1 \text{ per cent}$$

(b) $$S = 81{,}000{,}000 \frac{1 \times 4000}{500{,}000 \times 400^2} = 4\ 05 \text{ per cent.}$$

(c) $$S = 81{,}000{,}000 \frac{1 \times 800}{500{,}000 \times 400^2} = 0.81 \text{ per cent.}$$

The paper concluded with a discussion of the use of the oscillograph in testing the accuracy of speed regulation in commercial installations.

The Tilbury and Romney Oil-fields in Ontario*

C. W. Knight in his report on "Oil and Gas in Kent County," from observation made in July, 1907, treats of the new Tilbury and Romney fields lying between Lake St. Clair on the northwest and Lake Erie on the southeast, where important developments of both oil and gas had for some time been progressing. On July 1, the number of producing wells drilled in Tilbury was 235, besides 33 dry holes while in the Romney pool at the same date there were 47 wells drilled of which 24 were dry. The production of oil in the Tilbury field for the first six months of 1907 was given by C. O. Stillman of the Imperial Oil Company, Sarnia, as 186,583, and that of the Romney field at 38,296. While the production of the Tilbury field varied little from month to month, the Romney output showed a steady decline, having fallen from 11,10[illegible] barrels in March, to 3163 in June. Various reasons for the suspension of operations at some wells. apart from the exhaustion of the oil, are given to account for the falling off; lack of water for boilers and delay until a supply of natural gas can be piped in, being among them.

As the receipts of crude oil from all Ontario sources by the Imperial Oil Company, by far the largest purchaser, for the first six months of 1907 amounted to 391,350 bbls. it will be seen that the output of these two new fields is more than half that of the whole province. Mr. Stillman estimated the production from the Tilbury and Romney fields at 30,000 bbls. per month for the ensuing 10 months. The color of the Tilbury oil in bulk is a dark olive green, which changes to pale yellow or amber when viewed in a thin layer. It runs from 38 to 41 deg. Baumé standard. The Romney oil is described by refiners as a "dead" oil and contains a high percentage of sulphur. A small quantity of naphtha is extracted from it at the refinery and the remainder sold as fuel. It is about 28 to 30 deg. Baumé. There are several important gas wells in East Tilbury and the adjacent portion of Raleigh township, from one of which the city of Chatham, 10 miles distant, is supplied. The rock pressure of the closed-in gas was about 460 lb. It closely resembles the natural gases found in Ohio and Indiana. Several smaller places and many farmers are also supplied with gas from the Tilbury field.

*Abstract from Report of the Ontario Bureau of Mines for 1907.

Use of Ferro-Alloys

According to E. F. Lake, in the *American Machinist*, Nov. 7, 1907, the effect of some of the ferro-alloys used in foundry work is as follows: Ferro-silicon tends to convert the carbon contents to a graphitic condition and so produce a soft casting. Ferro-chrome is a hardener and is used where hard wearing properties are desired, as in cast-iron piston rings. Ferro-phosphorus makes iron very fluid when molten and causes it to take a fine impression in the sand; it is therefore used to advantage in fine, thin, ornamental or artistic work where strength is not considered, for a high percentage of phosphorus makes iron very brittle. Ferro-aluminum is used as a deoxidizer and thereby refines the grain. Ferro-titanium acts as a deoxidizer and combines with both oxygen and nitrogen; therefore it aids in removing these gases and thereby produces sound castings. It increases the transverse strength and the hardness of the chill of cast iron. Ferro-vanadium refines the grain and reduces the porosity of cast iron, it also increases the breaking strength. Thus it is useful for such castings as valves and explosive-engine cylinders.

The Steel Rail Question

The Pennsylvania Railroad Company has, without waiting for the action of the railroad associations, adopted what is evidently a moderate and sensible method of settling the disputed questions relating to the manufacture of steel rails. In announcing that orders have been placed for 55,000 tons of new rails, the company makes the following statement:

These rails will be rolled under entirely new specifications. In view of the increasing severity of road service and the recognized necessity for developing an improved steel rail, the Pennsylvania Railroad has for some months been conducting an exhaustive examination of the entire art and practice of rail manufacture. A committee of experts—representing not only the railroad but two of the important steel manufacturers—was appointed by the Pennsylvania system last summer to make a special study of the subject. The experiments undertaken were probably unprecedented in their completeness and in the importance of the scientific data which they supplied. The rail sections are believed to be a distinct improvement upon those hitherto in use on the Pennsylvania system.

Most important of the features of the new specifications is the placing more upon the manufacturer the responsibility for the character of the rail produced. The company recognizes that it is merely a purchaser—not a manufacturer. Considerable latitude is, therefore, to be allowed in the methods of manufacture utilized, so long as the result is a sound rail. The company has devised tests of a character so exacting that it is made very much to the interest of the manufacturers to discard all material of the soundness of which there is any doubt.

No specification, for example, is made as to the amount which shall be sheared from the end of the bloom formed from the top of the ingot. The problem of a proper discard has been discussed very freely by the different societies which have been considering rail specifications. Various percentages have been proposed—a discard of 25 per cent. having the greatest number of advocates. The Pennsylvania Railroad feels, however, that in the present state of the art, at any rate, the responsibility for a proper discard should be left with the manufacturer.

The new specifications also provide that rails shall be free from "injurious" mechanical defects and flaws. This differs from the old specifications in that no attempt has been made to describe the particular defects or flaws that will cause the rejection of rails. It is not considered wise to attempt to classify in the specifications the relative importance of defects, but it is specified that no rails will be accepted that contain defects or flaws which in any way impair their strength.

The methods to be used in testing the new rails are very elaborate and comprehensive. To strengthen still further the practice of the company and to insure that whatever future changes are made shall be based upon accurate data, a system has been devised whereby the history of all rails purchased by the company shall be fully recorded. In order that, for this purpose, it may be possible to identify the part of the ingot from which particular rails were made, the new specifications require, in addition to the usual marking, that a letter shall be stamped on each rail to indicate its position in the ingot. To compile and consider the company's experience with rails, a special committee is to keep continually in thorough touch with the art, and is expected to supply the company with data that will enable it to secure the best rails which, at the time of any order, it is possible to manufacture.

In placing its orders, the Pennsylvania Railroad invites the steel manufacturers to undertake to fill part of the allotment with rails made by the open-hearth process. It is desired to ascertain more clearly the actual differences in service as between the open hearth and the bessemer product.

The Goldfield Mine Owners Adopt the Open-Shop Principle

The Goldfield Mine Owners' Association passed a resolution Jan. 29 adopting the open-shop principle of operating the Goldfield mines. A copy of the rules and regulations adopted is to be posted at each mine. The rules are as follows:

"This mine is to be worked under the open-shop policy of the Goldfield Mine Operators' Association, hiring and discharging men without regard to whether they do or do not belong to any labor organization, and under the following rules and regulations:

"1. The time of each man on every shift belongs to this company and to no one else.

"2. No walking delegate or other representative of any labor organization is to be allowed upon these premises at any time or for any purpose.

"3. No soliciting of membership in any labor organization is to be allowed upon these premises at any time by an employee of this company or by any one else.

"4. No discussion of labor questions, either for or against unions, or in any way connected therewith, is to be allowed during working hours, or upon these premises at any time or under any circumstances.

"5. No employee of this company is to be annoyed or interfered with by any other employee in his work in any way whatsoever because he may or may not belong to any labor organization, or for any other reason, and all employees are to work together harmoniously for the best interests of the company.

"6. No employee of this company is to harass, intimidate or interfere with any working man of the Goldfield mining district because he does or does not belong to any labor organization.

"7. All employees are requested to report any violations of these regulations to the management, and any employee found guilty of violating them, or any part of them, will be immediately discharged and be disqualified from any further employment by this company.

"8. Any outsider violating any of these rules will be immediately ejected from the premises and prosecuted by law for trespass."

Platinum in California

SPECIAL CORRESPONDENCE

It has recently been discovered that the old dumps of the one-time famous Blue Point mine at Smartsville, Yuba county, California, carry platinum, none of this metal having been saved while the mine was being worked years ago. Instead of mere waste, therefore, these dumps may make the mine a valuable one. The property is being re-opened after a long period of idleness, and is to be worked on an improved system not yet made public in detail.

It may be stated, in this connection, that the gravel in the dredge diggings in Folsom district, Sacramento county, has lately been found to carry more platinum than it was supposed to and devices are being adopted to save this metal as well as the gold. Some exhaustive experiments have lately been made with improved gold-saving appliances, in the course of which it was found that quantities of platinum had been going to waste with the tailings. All this is now being remedied and it is expected that considerable profit will result from exercising care in saving the platinum content of the auriferous gravel.

Tungsten in ore can be tested for in the field by the following method: Pan the crushed ore so as to separate the heavy minerals from the gangue. Then boil the concentrate in hydrochloric acid for 20 to 30 minutes in a glass vessel, for instance a beaker. About five minutes before the end of the boiling add nitric acid, using one-quarter the volume of the hydrochloric acid. A canary yellow precipitate of tungsten trioxide will be formed, if tungsten is present, and this will adhere somewhat to the vessel. If this precipitate is soluble in ammonia, there is no doubt of its having been formed by tungsten.

The Takilma Smelter, Oregon

By George Crerar*

The Takilma smelter is located about 43 miles south of Grant's Pass, Josephine county, Oregon. It has one furnace, built by the Power and Mining Machinery Company, 42x96 in. in cross section at the tuyere level and 54x96 in. at the feed floor. The distance from tuyere centers to feed floor is 94 in. The blast is supplied by one Connellsville blower, direct-connected with an Erie slide-valve engine, and delivering 45 cu. ft. of air per revolution.

The plant is equipped with a blacksmith shop, a machine shop and a sampling mill. The sampling mill contains one 7x9 in. crusher, one set of rolls and a coffee-mill grinder. The ore, brought down from the mines in wagons, is shoveled into the receiving bins, every 20th shovelful being placed in a wheelbarrow which, when full, is dumped into a sample bin, which opens below, opposite the crusher on the sample floor where the sample is finished. One sample is cut down daily, representing the quantity of ore hauled during the preceding day.

Two ores are smelted; they are somewhat similar in chemical composition, but differ considerably in their physical characteristics. For convenience we have designated one ore as "base"; this is mined in coarse, hard lumps, and the copper in it is combined with the sulphur as chalcopyrite; the greater portion of the iron is present as pyrite and a sulphide having the composition, Fe_7S_8.

The following is an analysis of the "base" ore: Sulphur, 17 per cent; copper, 5.6 per cent.; iron, 27.3 per cent.; lime, 2.5 per cent; alumina, 7.4 per cent; silica, 27 per cent.

The ore called "silicious" is a rather soft and very much broken-up material. The greater portion of the copper is present as chalcocite and the iron as pyrite.

Chemical analysis of this ore gives the following composition: Sulphur, 12.5 per cent.; copper, 8.5 per cent.; iron, 19.2 per cent.; lime, 0.0 per cent.; alumina, 11 per cent.; silica, 40 per cent. The limestone flux used is obtained about one mile from the smelter and is very pure, averaging 98 per cent. calcium carbonate.

Smelting Operations

For the most part the furnace is run on a charge composed of: 1200 lb. silicious ore; 350 lb. base ore and 450 lb. limestone, dry weight. To smelt this charge 240 to 250 lb. of coke, or 12 to 12½ per cent. of the charge, is required, and gives a matte averaging about 39 per cent. copper. In order to avoid excessive flue-dust losses the blower speed is maintained at an average of 85 to 90 r.p.m.

*Manager, Takilma Smelter, Takilma, Ore.

The slag produced has the following average composition: Silica, 42.7 per cent.; iron oxide, 23.5 per cent.; lime, 19.5 per cent.; alumina, 12.6 per cent., and copper, 0.33 per cent.

The condition of the ore supply at times requires us to make runs of several days at a time on a straight "base" ore charge, composed of 2100 lb. ore, and 250 lb. limestone, dry weight. This is smelted with an average coke charge of 180 lb., or 7.67 per cent. of the charge, the blower speed averaging 95 to 100 r.p.m. The matte produced contains about 22 per cent. copper. The composition of the slag with this charge is as follows: Silica, 45.3 per cent.; iron oxide, 27.4 per cent.; lime, 15.1 per cent.; alumina, 10 per cent., and copper, 0.25 per cent.

The matte from this charge is run into flue-dust beds and in turn re-smelted with "silicious" ore, the following charge being employed: Silicious ore, 1350 lb.; matte, 400 lb.; limestone, 350 lb., dry weight, the matte produced averaging 39 to 41 per cent. copper. From 200 to 220 lb., or 9.5 per cent. coke is used on this charge and the blower speed is 90 r.p.m. The slag from this charge has the following composition: Silica, 42 per cent.; iron oxide, 28.4 per cent.; lime, 15.1 per cent.; alumina, 13.4 per cent, and copper, 0.33-0.35 per cent.

All flue-dust recovered is saturated with water and returned to the furnace as fast as produced. One man, with a wheelbarrow, for one shift daily handles this product. The slag is granulated and sluiced away by means of a jet of water under about 40-lb. pressure.

The Goldfields of Mysore

Consul-general William H. Michael, of Calcutta, contributes the following account of the gold-mining operations in parts of India:

Mysore is one of the most healthful, beautiful, best governed, and most progressive divisions of India. The State is forging ahead in internal improvements in the way of railways, electric trams, mills and factories, improved agricultural development, the improvement of water powers, the opening of manganese and gold mines, and in the education of the people.

The State has two cities of importance —Mysore and Bangalore. The latter is a popular "hill resort," and has modern hotels and residences. The population of the State is about 5,000,000, and the area 24,723 square miles. The land is unduly and broken and lies from 1800 to 3500 ft. above sea level.

The soil is rich, and the country has a number of important rivers. Forests are plentiful and contain abundance of teak, blackwood, and other varieties of hard wood. There is considerable canal irrigation and some large tanks and numerous wells for irrigating purposes. As a rule, however, the rainfall is abundant and fairly well distributed. Bangalore and Mysore cities are reached by rail from Bombay and Madras, and the State contains several short lines for the accommodation of mines and commerce and passengers. The discovery of manganese ore in large quantity and of excellent quality has given an impetus to all kinds of business, and the successful opening of gold mines and other mineral resources has added to the general prosperity of the State.

The geological structure of Mysore is mainly hypogene schists penetrated and broken up by plutonic and trappean rocks in every form of intrusion and overlaid with occasional patches of laterite and the kankar calcareous deposit. The gneissic rock about Bangalore possesses great economic value, being easily quarried from the surface. Gold is found between Anicul and Punganur, near Baitmangalam and Ooscotta, near the Batterine hills, and elsewhere. Gold and manganese in paying quantity have been discovered in parts of Mysore within the last two years where their existence was not suspected a few years ago.

Advance in Price of India Manganese Ore

Con.-Gen. William H. Michael reports that one year ago a proprietor of coal and manganese mines, of Calcutta, entered into a contract to furnish 5000 tons of manganese ore at $4.66 per ton, to be delivered not later than Feb. 15, 1907. He is now being sued for non-performance of contract. The evidence brought out the fact that good manganese ore, i.e., ore containing 50 per cent. of manganese, can not be had for less than $7 per ton. The rapid advance in the price of manganese ore in India during 1907 greatly stimulated the manganese industry.

Erratum

In the article entitled "Report on the Monongah Mine Explosion," by George Harrison, in the Journal of Feb. 1, page 264, by an oversight it was omitted to state in the foot-note that this article was an abstract of the report made by Mr. Harrison, assisted by Inspectors Jones, Turner and Miller, and not the report in full. There was, moreover, an error in the article. The statement, "The greatest force is most visible at the head of the principal heading on the No. 6 side," should have referred to the No. 8 side, a typographical error having caused the substitution of the numeral 6 for the numeral 8.

The Weg Breathing Apparatus

SPECIAL CORRESPONDENCE

In a recent article I gave some account of the recommendations of the British Royal Commission on Mines with regard to the adoption of a breathing apparatus for use in rescue work after explosions and in exploratory work after mine fires. One of the apparatus referred to is the "Weg," which is designed by W. E. Garforth, and is in use at the Altofts collieries of Pope & Pearson, situated in the West Riding of Yorkshire, England. It was described briefly in the technical press about five years ago, but the present time is opportune to give an account of its latest form and also the results of tests made by the Royal Commission. I should also add that the Fifeshire coal owners have recently joined hands in starting a central rescue station and are to use Mr. Garforth's apparatus.

DESCRIPTION OF THE APPARATUS

The accompanying illustrations show the arrangement of the apparatus. Briefly, the wearer breathes into and out of a bag which is provided with such arrangements that the carbon dioxide is absorbed and oxygen from a steel cylinder supplied to replace that which is used up. The supply of oxygen is regulated automatically with the consumption and in this way differs from the "Heuss" and other similar apparatus in which the supply of oxygen is constant. The cap *F*, Fig. 2, fits the head of the wearer, and each cap has to be suited to the individual head. It is not in the nature of a diver's helmet. The fact of its fitting this way provides, as it were, a safety valve in case the pressure inside should for any reason become too great. The oxygen cylinders are shown at *A*. The negative pressure of inhalation draws oxygen through the special regulator *E* and up the pipes *C* into the pipe *P*. The air expired by the wearer passes down the pipe *K* to the potash purifier *L* on the back, and after having its carbonic oxide removed, passes through the pipes *M* into the breathing bag *N* below. From this breathing bag the air is drawn up through the pipe *P*, where it is revived by the admission of oxygen as described. Valves are arranged at various points so that this circulation of the air is properly maintained. There is a pressure gage at *S*, and a direct pipe *G* which in case of emergency can be used to supply oxygen direct to the mouthpiece.

CYLINDERS HOLD 150 LITERS OXYGEN

The whole apparatus weighs about 30 lb. It is comfortable to wear and gives great freedom of movement. The cylinders contain 150 liters of oxygen at the atmospheric pressure, and the consumption varies from ⅓ to 1⅔ liters per minute. Tests of the apparatus were carried out by the Royal Commission, in the experimental gallery, filled with unbreathable smoke. In the first test the subject worked very hard for two hours, lifting weights chiefly, the total work being 77,000 ft.lb. The analyses showed that the absorption of carbonic acid was good, and the constantly rising percentage of oxygen indicated that the apparatus was being washed out all the time. The consumption of oxygen was only 1¼ liters per minute.

FROM 0.4 TO 1.6 LITERS OF OXYGEN USED PER MINUTE

The second test commenced with a period of rest extending over an hour and a half. The subject then used less than ⅓ of a liter of oxygen per minute. Afterward an hour and a quarter's hard work was done, during which the measured work was 92,000 ft.lb. The consumption of oxygen rose to 0.7 liter per minute. In the third test there were five men at work for 1¼ hours extinguishing fires, putting up screens, and carrying stretchers. The average consumption during this test was as high as 1.6 liters per man per minute.

The report of the commissioners is generally favorable to the apparatus. They state that it works satisfactorily during rest and work. They point out that during a rest after heavy work it might be possible for the inspirations not to be strong enough to draw in sufficient oxygen, and recommend the introduction of extra oxygen through the apparatus to be obtained either through the direct pipe to the mouthpiece or by altering the inlet valves. They also point out that the oxygen must be specially prepared so as to contain a minimum of nitrogen or else the contents of the apparatus may become insufficiently high in oxygen. Neither of these points is at all inimical to the value of the apparatus.

FIG. 1. WEG BREATHING APPARATUS

Coal Mining in North China

Consul W. T. Gracey, of Tsingtau, reports that the mining concession of the Shantung Mining Company extends 10 miles on either side of the railway from Tsingtau to Tsinanfu, which passes through two coalfields—Fengtsze, about 120 miles from Tsingtau, and the valley of Poshan and Tzu-ch'uan, about 168 miles from Tsingtau, adjoining which are the iron mines of the Tieh-shan, near Chin-ling-chen.

The coalfield of Wei-hsien is remarkable for the irregularity of its coal seams. Borings have shown that the surrounding country was the scene of violent volcanic eruptions, which greatly disturbed the coal deposits. The theory advanced to account for the pockets of coal embedded in the granite, which have been exploited by the Chinese, is that vegetable matter was deposited in original crevices in the granite. The remains of the Chinese shafts are distributed in small clusters where these pockets are found, and are separated from each other by the outcropping granite. As the Chinese miner cannot go deeper than 180 ft., on account of his inability to cope with the water, it is not known how deep these pockets are. Their lateral area is so small that the Chinese have practically ceased to mine them.

After boring for a year the recent explorations disclosed a seam of coal about 9 ft. thick at a depth of 450 ft. The Wei-hsien coal is a bituminous coal containing about 30 per cent. of gas. It burns with a clear flame and does not cake. During 1906 the Fengtzse mine (Wei-hsien district) raised 163,000 tons of coal, a gain of 29,223 tons over 1905.

The valley of Po-shan, in which are the towns of Po-shan and Tzu-chuan, is about 20 miles long and from 200 yd. to nearly six miles broad. The whole of this valley is a vast bed of coal, situate at a deeper level in the middle and appearing on the surface at the edges. At the northwest exit of the valley the coal bed is interrupted by a chain of limestone hills, but it commences again and continues in undiminished quantity in a westerly direction for another 20 miles between the main range on the south and the Changtai-shan on the north. In this valley and its branches are situated the mining centers of Pu-chi and Pu-chuan. The best quality of anthracite is found near the surface in the Hei-shan valley, and it is on account of this coal that Po-shan has been famous.

The Shantung Mining Company, on the supposition that the superior Hei-shan coal, which crops out at the head of the valley, is the continuation of the main coal bed, has attempted to strike it at a lower level nearer the main railway line, which crosses the entrance of the valley. Boring trials have been carried on with very satisfactory results. The Po-shan mines raised 7136 tons in 1906. Briquets are now being manufactured from the smallest coal mixed with coal-tar pitch. Coal-washing machinery was set up by the mining company during the year and commenced operations in July. At Tsechuan the first seam of excellent coal was reached in July. A greater output will commence after the mounting of the machinery now in Tsingtau.

The mines of the Chinese Engineering and Mining Company, while no longer the only source of coal supply in north China, continue to occupy the first place. The total output of the mines in 1906 amounted to 958,675 tons, as compared with 851,523 tons during 1905. The railways took 136,077 tons as locomotive fuel. The supply of bunker coal to steamers required 48,320 tons. The local market at Tientsin and the immediate vicinity consumed 201,155 tons; into Manchuria, by rail, were sent 43,184 tons, and at various stations along the railways, exclusive of Tientsin, amounted to 302,882 tons. The exports by steamer to Shanghai, Chinkiang, and Hankow were 102,615 tons, and to the northern ports 51,289 tons. The ports of Tsingtau and Lung-kow are now largely supplied with coal from the Shantung mines. No serious attempt has been made as yet to widen the market for this company's coal, as the places and uses named above have absorbed nearly the whole output. Every effort is now being made to increase the output, and there was a heavy expenditure on new plants during 1906 with that end in view. The mines of the Peking syndicate in northern Honan have encountered obstacles and setbacks which have greatly delayed their development. Nevertheless there is from these mines a regular production of a very good quality of anthracite coal, which, besides supplying the consumption of the locomotives of the Tao-ching Railway, is largely used as fuel at Tientsin. A 14-ft. seam was reached in March, 1906, and a 12-ft. one in November, 1906. An excessive flow of water and other difficulties have made a heavy output impossible, but work is energetically proceeding toward the overcoming of these difficulties, and it is hoped that large supplies of coal will be placed on the market in 1908. Another mine which is already a regular producer and of which great hopes are entertained is the Tsing-kiang mine in Shan-si. This mine produces both bituminous and anthracite coal of good quality.

In experiments made in mine flushing in Silesia, Germany, a cast-iron pipe 4.53 in. in diameter and 0.472 in. in thickness gave perfect satisfaction, and passed daily 35,000 cu. ft. of packing material. When the roadway inclined from 20 to 25 deg. it was necessary to turn the piping after six months' use. When the roadway was nearly horizontal, the turning was done only after nine months' use. The pipe line was turned three times, and lasted between 18 and 27 months. The turning must be done before the walls become too thin. The pressure of any considerable amount of air in the pipes must be prevented, for when the pipes are stopped up, the air may cause a high pressure. The pipe should be inclosed with cheap wire netting to prevent accidents in case they break. The cost of the piping, installation, etc., was found to be 0.5 to 0.6c. per ton of coal won.

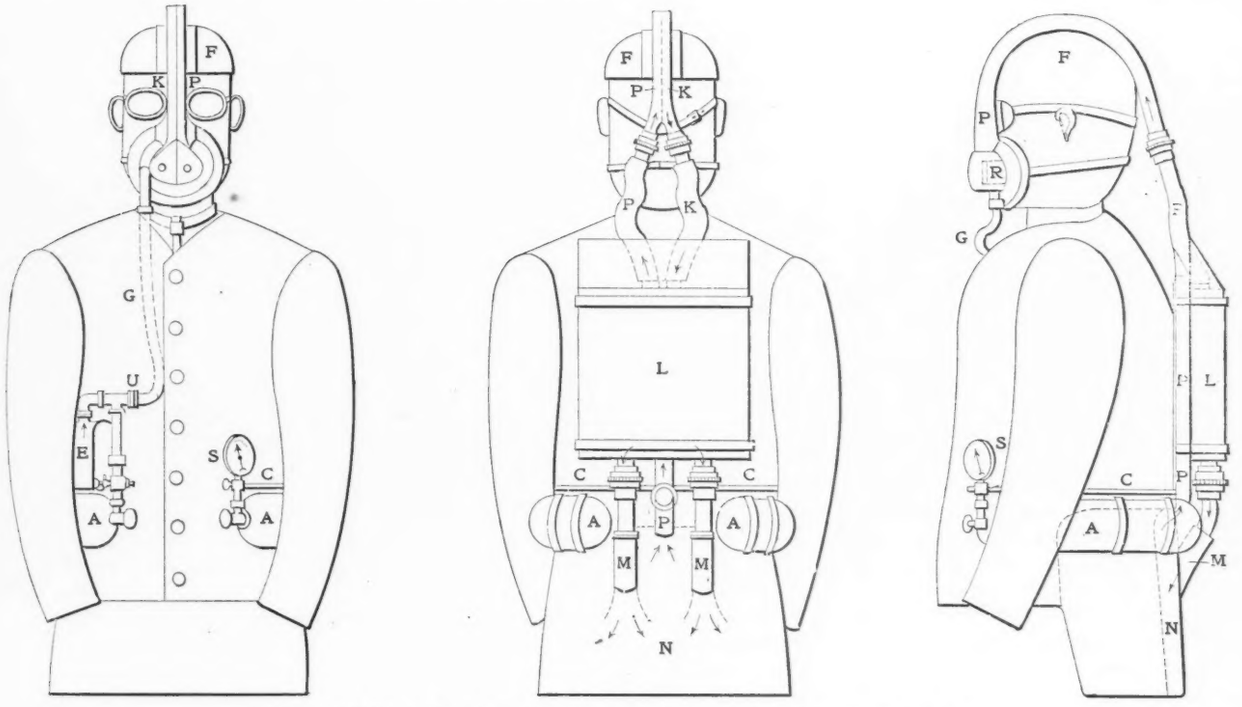


FIG. 2. FRONT, BACK AND SIDE VIEWS, SHOWING ARRANGEMENTS OF PARTS

Explosions in Bituminous Coal Mines

By G. P. Bartholomew*

The terrific explosions in the bituminous fields which have followed one another during the past 10 weeks with due regularity should certainly be food for anxious thought and consideration on the part of all who are interested in one way or another in the business of mining. The search for the cause of any individual disaster aids in no way the results of the calamity, and if found can only serve as a feature to be eliminated in the prevention of its repetition. At the best, any conclusion arrived at is but a conjecture, as evidence is generally so completely destroyed that it becomes circumstantial. The great problem of safety must be solved along the lines of prevention, rather than post mortem analyses.

There are one or two features which have been but lightly considered in the controversy, but which to my mind are of great importance, and which have been forcibly impressed through many years of active connection with the coal-mining industry. The question of ventilation is one which is far too often relegated to the supervision of the mine foreman or fire boss, instead of being directly under the charge of a competent engineer. As our mines increase in size and depth, the problem increases daily in engineering difficulties, and each individual case should be made the subject of constant study from a purely technical standpoint, as it is indeed capable of being solved only by the display of the most expert judgment and training. The average operator concentrates his own energy and that of his employees toward getting out the coal in the cheapest possible manner, at the sacrifice of the ventilation problem, at the same time always running the risk of paying heavily for the consequences. This is a short-sighted policy. No mine can be declared free from gas. I have known mines operated for years without having encountered any signs of gas, suddenly develop the same, at the most unexpected moment. Proper ventilation requires air in sufficient quantities to at all times dilute any gas present, to make its explosion impossible. To accomplish this requires eternal vigilance.

The fire boss is concerned apparently only in determining whether gas is present in the workings already developed. He is not responsible for the system of operation, nor is he supposed to be familiar with the finer technicalities of the problem, which can only be handled by the expert. The average engineering force is today inadequate to do justice to the great amount of work required of them. The engineer's authority should be supreme and his responsibility likewise. His ability should be high-class, which must be paid for, and, needless to say, the money would be well spent. A well-defined system of operation once decided upon can be easily developed, providing the rules are strictly adhered to. But no system should be tolerated that does not make the question of adequate and proper ventilation of first importance. Its solution is a matter of education and training, and should be supervised by capable engineers with a crew whose ability is of sufficient caliber to carry out his instructions. This after all is, alas, a question of economics.

*Engineer with E. I. du Pont de Nemours Powder Company, Wilmington, Delaware.

Dangers Attending Coal Mining

The recent disasters in coal-mining operations in this country have provoked a discussion among mine inspectors and experts in the anthracite region, and there is a consensus of opinion that there is not a sufficient observance of the mining laws, while there are many who are strongly in favor of a recasting of the laws of the various States regulating the mining industry. The following comment from the report of the chief mine inspector of Pennsylvania, James Roderick, has been made public:

"The mining of coal is a most dangerous vocation, the lives of the men engaged in it are always in jeopardy, and yet the exercise of care and judgment on the part of both employer and employee would eliminate much of the danger. It is true that the managers of the mines of Pennsylvania have adopted rather stringent rules in their efforts to safeguard the miners, and have spent large sums of money to make the mines safe. But the fact still remains that the chief object of the management is to produce the greatest amount of coal at the smallest cost. The employees inside of the American mines are producing more coal per person than the employees of mines in any European country, and are also earning more money than the foreign employees. With all this strenuous effort, it may still be doubted whether the American employer of labor in the coal mines is earning any larger dividends on his investment than the European employer of similar labor.

"The question is, does this combined effort on the part of employer and employee to increase the production add to the perils that already surround this occupation? If so, it is time to call a halt on both employer and employee and insist that they give greater attention to safeguarding the lives of the people in the mines.

"The dangers cannot be entirely eliminated, but they can be lessened greatly if the common and well known precautions are taken. The roofs should be made secure, care should be taken in the handling of explosives, in dealing with gaseous mines, in running the mine cars, in operating the machinery of the hoisting shafts and the machinery in and about the breakers. Undoubtedly many accidents could be prevented if greater precautions were taken. From my experience of many years I am of the opinion that nothing but the strictest laws that will reach both the employer and employee, with penalty clauses attached that can be enforced, will prevent the sacrifice of lives in the mines of Pennsylvania. There can be no good reason advanced why the American operator and the American miner cannot be made to observe the laws made for their mutual benefit and protection. I would again suggest that a commission of experts be appointed to prepare a mining law that will be comprehensive enough to cover the needs of both the anthracite and bituminous mines. The law should carry with it the power to punish all violators of its provisions."

The Arkansas Coalfield

The Arkansas coalfield comprises the east end of a large area of coal land which has its greatest extent in Indian Territory. The coals belong to two great geologic systems, called by geologists the Carboniferous and the Tertiary, but only those of the older system—the Carboniferous—have been exploited and are known commercially. They grade from bituminous to semi-anthracite, and recent experiments at the United States Geological Survey fuel-testing plant at St. Louis have shown that they are of a quality not found elsewhere in the United States west of West Virginia.

The coalfield described by Arthur J. Collier, of the United States Geological Survey, adjoins the Indian Territory line, from which it extends eastward along the valley of the Arkansas for 75 miles. It is about 50 miles wide at its west end, but the belt containing workable coal contracts abruptly 12 miles from the boundary, and beyond this point its average width is not more than 20 miles. The workable coal areas are more or less irregularly distributed over this district, and many of them are in detached basins not known to be connected with one another. The productive areas of the east end of the field are north of the Arkansas river; those of the west are south of it.

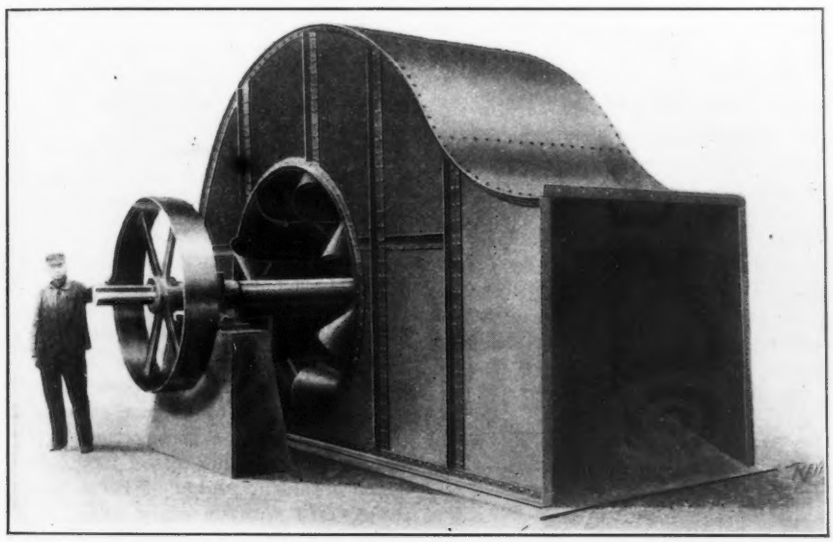
The development of the coal industry in Arkansas on a commercial scale began about 1870, and the production increased to a maximum in 1903, when the output amounted to 2,229,172 short tons. A slight decline in the production after 1906 was caused by the competition of fuel oil from Texas, but present conditions indicate that the demand for Arkansas coal is again increasing.

A New Mine Fan

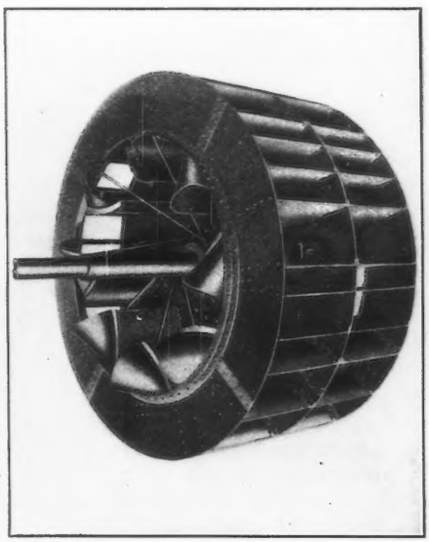
In view of the many recent mine explosions due to insufficient ventilation, probably in remote workings, special interest attaches to the announcement of a new centrifugal mine fan by the Jeffrey Manufacturing Company, Columbus, Ohio, for which it claims high efficiency, as indicated by the accompanying table. These results are obtained from a fan 10 ft. in diameter by 5 ft. wide, shown in the accompanying engraving. The ventilator has been installed for purposes of demonstration at the company's works in Columbus.

The special features which give this fan large volumes at slow speeds and a large capacity against high gages are the concave curved vanes which discharge the air in a true radial direction with no dragging effect on the wheel, and the conical scoops which, by their special forms and positions, prevent the gushing of air from the inlet.

The fan is made entirely of steel mounted on a hammered-steel shaft with accurately machined cast-iron hubs, and is held rigid and true by adjustable stay rods which offer no obstruction to the free inlet of air. An advantageous feature is also the steel casing which extends to the ground line, eliminating the large amount of masonry usually required with fan installations.



NEW STYLE JEFFREY CENTRIFUGAL MINE FAN



SECTIONS OF MINE FAN SHOWING CURVED VANES

RESULTS OF FAN TEST

	Fan Discharging Into Free Air.					Outlet Closed.	
R.P.M.	In. Wtr. Gage.	Area of Discharge. Sq.Ft.	Vel. of Air. Feet Per Min.	Volume. No. Cu Ft. Per Min.	Volumetric Capacity.	In. Wtr. Gage	Manometric Efficiency.
50	0.15	34	1530	52,020	265 %	0.22	67 %
100	0.6	34	3070	104,380	266 %	0.9	66 %
150	1.4	34	4700	159,800	271 %	2.0	70 %
200	2.5	34	6280	213,520	272 %	3.6	71 %
250	3.8	34	7750	263,500	268 %	5.3	72 %
300	5.6	34	9390	319,260	271 %	8.0	70 %

Coal Mining in Ohio in 1907

By George Harrison*

Although accurate statistics for 1907 are not yet available, still it is not too early to say that, taken as a whole, the coal industry of Ohio has just cause for congratulation on the amount of business transacted during the year. The general prosperity of the country at large added materially to the demand and consumption of the product. An estimate of a coal tonnage amounting to 30,000,000 tons may not be too high; a less conservative estimate places the total at 32,000,000 tons.

The coal trade was not affected by labor disputes, or strikes which would in any way very materially curtail the output, and the mines, as a rule, worked over half time. The disastrous flood which took place during the month of March for a time interfered with the operation of some of the mines in the Hocking Valley district. The railroads, however, were the greater sufferers, bridges, trestles and tracks being swept away. The Lake trade was about up to the usual standard, and it is believed that shipments will be largely increased.

The scarcity of cars caused no serious trouble; the railroads seemed able to meet all demands made upon them. During the month of October the demand for coal fell off somewhat owing to the reduction of activity among large manufacturing concerns, due to the financial disturbances of the latter part of the year.

The coal tonnage of the State was disposed of at satisfactory prices, and balances covering mining operations at the close of the year will, no doubt, be on the right side of the ledger.

While Ohio had more of the deplorable catastrophes accompanied by serious loss of life which marked the year's operations in adjoining States, yet the death rate for the year 1907 will be far greater than any hitherto recorded. The fatal accidents will number more than 150, an increase of possibly 25 as compared with the previous year. While, in all probability, there will be a decided increase both in the coal tonnage, and in the number of men employed in the mines the fatalities will undoubtedly have increased far beyond what the increased tonnage and number employed would justify. Until the General Assembly of the State provides better mining laws, little can be looked for in the way of reducing the number of fatal accidents.

*Chief inspector of mines, Columbus, Ohio.

According to the United States Geological Survey, the period of failure and discouragement in the manufacture and use of briquetted fuel in the United States has probably passed and the industry will doubtless now be placed on substantial and profitable ground.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

There are but two coal briquetting plants in Pennsylvania, both of which were put into operation in 1906.

In the Kalgoorlie district, West Australia, three-compartment shafts are commonly used. The hoisting compartments are generally 5x4 ft. in the clear and the ladder compartment 5x5 ft. 6 in.

One of the reasons assigned for the comparatively slow development of the by-product coking ovens in the United States is the lack of a profitable demand for coal tar, an important by-product of retort coke.

In working thin seams of coal, broad, low cars give the best results. The hopper-shaped car is best adapted to a narrow gage when it is desired to increase the capacity without increasing the length or hight of the car.

All shaft head gears should be of good hight, especially where large drums are used. Uprights and back stays should be set on concrete foundations. Back stays should always be carried to the center of the pulleys in order to give them greater resisting power against the strain of hoisting.

All oil for use on machinery exposed to the weather should have a good cold test. In order to find the cold test or point at which oil congeals, place a bottle of oil in a mixture of cracked ice and salt, or calcium chloride, or immerse it in a tank of brine, insert a thermometer in the bottle and note at what temperature the oil hardens.

A good way to determine the difference in working temperature of two lubricating oils, is to place a thermometer in the bearing with the bulb submerged in the oil cup or resting on the shaft. In making a test of this kind the temperature of the room; the rate at which the oil is fed to the machine; the pressure on the bearings and the tension on the belt must be kept constant.

In the few mines with hard roof and floor, complete watering with a hose gives good results in that it thoroughly reduces the dust. In deep, hot mines the use of water is sure to affect seriously the health and efficiency of the miners. If watering is used, the roof and sides must be sprinkled, as well as the floor, for the dust which settles there is more inflammable than the floor dust.

The purest and finest coal dust is the most explosive and it becomes less explosive in proportion to the shale and stone dust that are mixed with it. The dust at working faces is generally of a coarse character, and since it is not subjected to the same atmospheric conditions as that on road-ways, is less dangerous. Coal dust from machine-cut coal is finer and more dangerous than from hand-cut coal.

Superintendents of mines should themselves inspect all working places in every mine under their charge, at least once every month in order to see that the mine laws are generally obeyed. They should give especial attention to the ventilation at the working faces. Mine foremen should measure the air once each week in the last crosscut in the first room or breast and in the last cross-cut in the last room or breast of every entry or panel.

An engine having plain slide valves works with little or no expansion and uses much steam. The adjustable cut-off valve works with a fixed ratio of expansion determined by the judgment of the engineer. In an automatic cut-off valve the ratio of expansion is determined by the engine itself, that is, it meets the requirements of the load of the engine at any given instant of time and is thought to be the most economical type.

Professor Abel has proved that an inert substance, such as bone dust, will cause an explosive mixture to form if suspended in a mixture of air and fire-damp of a non-explosive nature. In a mine, which gives off a small amount of fire-damp, but is considered safe, because of the large amount of air passing through the workings, the presence of fine dust suspended in the atmosphere will sometimes cause an explosion, if a naked light is used.

The barks of oak, hemlock and other woods are effective in preventing the formation of scale in boiler water containing carbonates of lime or magnesia. Milk of lime and metallic zinc have been used with success in water charged with bicarbonate of lime as they reduce the bicarbonate to the insoluble carbonate. Soda ash is useful in waters containing sulphate of lime as it converts the sulphate into carbonate, which forms a soft scale, easily removed. Petroleum is used in water containing sulphate of lime.

New Castle, New South Wales, is about to install four dumping machines of the McMyler type for the shipment of coal. Each dumper is capable of shipping 600 tons of coal an hour, while a crane ships only 100 tons an hour. The machine has other advantages in addition to expeditious shipment. The coal is run through a telescope chute with a self-trimming device, which saves the fuel from being broken up to the same extent as it is at present when dumped into the vessels. The equipment will cost about $350,000.

Among the reasons for the halting progress in fuel briquetting is the lack of assurance of a regular supply of coal-tar pitch at reasonably low prices for use as a binder. Out of the many attempts that have marked the incubating period of the briquetting industry—some of them costly—has grown the knowledge that, in the Eastern States at least, coal-tar pitch must be relied on to supply all or the greater part of the binding material. In California, Arizona, and other parts of the far West, asphaltic pitch, a residual product from the refining of the heavy asphalt-base petroleums of that region, has been and is now successfully used in briquetting plants.

With our millions of acres of coal-producing lands, in which coal can, in most places, be cheaply mined, it has appeared in many districts to be more economical to waste the slack or culm that constitutes a considerable percentage of the product than to attempt to save it at the additional expense required for briquetting. For this reason large tracts in the anthracite region of Pennsylvania are covered with unsightly culm banks, and in some of the bituminous districts huge piles of unmarketable slack are burned in order to get rid of them. Many thousands of tons of material that might be converted into usable fuel have thus been wasted every year, simply because of the increased expense involved in its preparation.

When trying to overcome knocking in an engine, see to the adjustment of the valves, which ought to afford enough cushion to take up the momentum, and gradually transfer the stress. If the knocking does not yield to this treatment, look into the bearings and boxes, and see if there is too much lost motion. If the knocking seems to be outside the cylinder, look for evidence of heating. Make an inspection to see if the rod swings fairly by the pin, when tight in the cross-head. Be sure that the crank pin is square with the web and that the web is square with the shaft. Make an inspection to see if the crosshead is true, the rod in line with the guides and central in the stuffing box. Above all see that the piston is central and tight, for a very small amount of motion will often make a large amount of noise.

THE ENGINEERING AND MINING JOURNAL

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROBERT MCKEAN, Sec'y.

505 Pearl Street, New York.

London Office: 6 Bonverie Street, London E. C., Eng.

CABLE ADDRESS "ENGMINJOUR, N. Y."

Subscription, payable in advance, $5.00 a year of 52 numbers, including postage in the United States, Mexico Cuba, Porto Rico, Hawaii or the Philippines. $6.50 in Canada.

To Foreign Countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 *we printed and circulated* 507,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for January, 1908, *was* 42,000 *copies.*

Feb. 1	12,500
Feb. 8	9,500
Feb. 15	9,500

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
- Iron and Steel Prices ... 371
- Copper Production ... 371
- Mining the Bingham Monzonite ... 372
- The Goldfield Trouble ... 372

*Metallurgy of the Kalgoorlie Goldfield. *Gerard W. Williams* 345

Mining Notes from the Transvaal. *Special Correspondence* 350

Buffalo Mines Company, Ltd. ... 350

Petroleum Lakes on Sakhalin ... 350

*The Merits and Demerits of Air-Hammer Drills. *G. E. Wolcott* 351

The Lemoine Diamond Scheme ... 354

Coal Mining in Alsace, Lorraine ... 354

*Consolidated Goldfields of South Africa, Ltd. *Eustace M. Weston* 355

Leasing of Coal Lands Urged ... 357

The Andrew Carnegie Research Scholarship ... 357

New Railway Construction in the Southwest. *Dwight E. Woodbridge* 358

The Canadian Mining Institute ... 358

*The Sweetland Filter Press. *Ernest J. Sweetland* 359

Canadian Graphite. *H. Mortimer Lamb* 360

Speed Regulation of High-head Water Wheels. *H. S. Knowlton* 362

Use of Ferro-Alloys ... 363

The Steel Rail Question ... 364

The Goldfield Mine Owners Adopt the Open-shop Principle ... 364

Platinum in California ... 364

The Takilma Smelter, Oregon. *George Crerar* 365

The Goldfields of Mysore ... 365

*The Weg Breathing Apparatus. *Edward Walker* 366

Explosions in Bituminous Coal Mines. *G. P. Bartholomew* 368

Dangers Attending Coal Mining ... 368

The Arkansas Coalfield ... 368

*A New Mine Fan ... 369

Coal Mining in Ohio in 1907. *George Harrison* 369

Colliery Notes ... 370

Correspondence:
- Negative Results in Pyritic Smelting. *G. F. Beardsley* 373
- Silver-lead Mines of the United States. *F. W. Heustis* 374
- The Moffat Road and Mining in Routt County, Colo. *W. C. Fitzsimmons* 374

The Nevada State Police ... 376

Exhibition of Safety Devices ... 376

New York and Honduras Rosario Mining Company ... 376

British Iron Trade in 1907 ... 376

Special Correspondence ... 379

Mining News ... 381

Markets, etc ... 386

Illustrated.

Iron and Steel Prices

The larger concerns in the iron and steel trade, under the leadership of the Steel Corporation, seem determined to adhere to the plan of maintaining prices, whether new business comes in or is wanting. At an informal conference held recently this declaration of policy was reaffirmed, and the announcement of the determination was made public. Similar action was also taken by a number of the owners of commercial furnaces, who are now holdng the price of pig iron at what is claimed to be a fair level. The leaders of the steel trade urge that they kept prices down when demand was strong, and that action on the reverse lines—holding prices up when demand has fallen off—is only equitable.

The first claim is justified by facts. The action of the large steel companies did, at the hight of the boom, prevent a runaway market, and was beneficial; though since the flurry of last March there has been manifest—slightly at first, but in increasing degree as the year advanced—a disposition to act more cautiously and to count the cost of material before carrying out a project. This was shown by the decrease of nearly 2,000,000 tons in orders on the Steel Corporation books between April and October. That the prices were sufficiently high, even under the conditions of high labor and other costs, is shown by the fact that the Steel Corporation was able last year to pay over $35,000,000 in dividends, and to appropriate nearly $58,000,000 from net earnings for the purchase of new property and the building of new works; its total surplus over all charges having been close to $106,000,000 for the year, notwithstanding the break of the last two months.

The questions to be considered, however, are not the fairness of prices, but can they be maintained? And would lower prices help the revival of business? Neither can be answered off-hand. At present the regulation of prices is comparatively easy, because new business is almost entirely lacking. As time goes by and business begins to come in, the temptation will be very strong for the smaller concerns, which must have some work to live at all, to secure what is coming by lower bids. The only way in which the larger companies can prevent this is by meeting the competition; and to do that would give away everything. Speaking from the experience of the past, this is likely to occur. It is true that the trade is more consolidated and under fewer heads than in any previous period of depression; but control is not yet sufficiently centralized to prevent all competition, and a chain is always liable to break at its weakest link. Already in the iron-bar market, which is almost the only open market, cutting and competition have begun which may have far-reaching results.

As to the second question, opinions will differ widely. The weight of all experience is, however, that after the first collapse is over, business is helped by lower costs. The opportunity to construct more cheaply, to carry through projects for less money, tempts capital and helps the undertaking of new work. The policy which built up the Carnegie works, the backbone of the Steel Corporation, was the reverse of that now adopted. The Carnegie plan was to increase efficiency and reduce costs, so that in time of depression every inducement in the way of low prices could be offered without actual loss to the maker. The success of that plan has been proved.

Time alone can show, however, whether the prices of iron and steel can be maintained when all the other metals of construction have fallen so heavily. It is a doubtful question, the final answer to which will be awaited with interest and anxiety. If the answer is in the affirmative, it will set aside all previous experiences.

Copper Production

In the concentration of attention upon the continued restriction of production at Butte and the difficulties that have arisen in Utah over the enforced closing of certain of the smelters there, the increasing capacity at other places appears to be overlooked. The number of producers of blister copper is, however, increasing. The Imperial smelting works at Sasco, Arizona, has already gone into operation. The Bully Hill in California will start shortly. The Mammoth, of California, and the Yampa, of Utah, are to put in converter plants. So will the Balaklala, of California, when construction is resumed there. The Steptoe works, of Nevada, will come into operation before the middle of the year. The Utah Consolidated has made a smelting contract with Garfield, which will take care of its ore

pending the erection of a new plant of its own. The Utah Copper Company, having further financed itself, is now rapidly completing its mill, and the Boston Consolidated has begun to ship to Garfield. The ability of Garfield to handle so much ore is a source of some wonder, but that plant is laid out on a very broad scale, and its capacity can be rapidly increased by installing new furnaces and converters, which is a comparatively small matter.

In the meanwhile the smelters of New York, which have a surplus capacity, are able to assist the West. The Yampa company, pending the completion of its converter plant, is to ship the matte to Chrome, N. J., which, of course, is less economical than shipping blister copper, but the transportation of matte so great a distance is in no wise extraordinary. Large quantities used to come East, and even now a good deal comes to New York from smelteries in California and Mexico which have no converters of their own.

However, all of this is a long way from making up for the absence of the great outputs of Washoe and Cananea. The question of greatest interest at present is, how long will Washoe be idle? Consequently attention is centered upon events at Butte. The policy of the Amalgamated company is shrouded in mystery. Among its subsidiaries the Anaconda is the greatest sufferer. It would be interesting to know what the minority stockholders of that company think about the situation.

Mining the Bingham Monzonite

The reports of the Utah Copper Company and the Boston Consolidated furnish instructive data as to the actual cost of mining the Bingham monzonite and go far to confirm the estimates of an extraordinarily low probable cost that previously have been made. The Utah Copper Company at the present time, according to C. M. MacNeill, its president, is producing about 3,000,000 lb. of copper per month at a cost of 7.95c. per lb. on the basis of the refined metal at New York. This is being attained although the Garfield mill is running on partially oxidized ore, which is lower in grade than the average of the orebody; also the mill is running at considerably less than full capacity. Consequently it is anticipated that when operations settle down upon the normal conditions, the cost of production will be materially reduced. President MacNeill indicates a cost not to exceed 7¾c. per lb. We have no doubt that he will be able to beat that (of course meaning direct operating expenses), but in the case of this company the minimum that can be reached will be governed largely by the proportion of its ore that can be mined by steam-shovel instead of by caving.

Mr. MacNeill says, "Our experience in mining by steam shovel has proved that our mining cost should not exceed 25c. per ton." The Boston Consoldated has not yet produced any copper from its porphyry mine, but during the year ending Sept. 30, 1907, it mined 2,011,733 tons of cap-rock at an average cost of 18¼c. per ton. Estimating the removal of one ton of cap-rock per two tons of ore this indicates a mining cost of 27⅜c. per ton of ore. It is satisfactory to note that these results are closely confirming the engineering estimates.

The Goldfield Trouble

In accordance with a resolution passed by Congress, the full report of the commission appointed by the President to investigate the situation at Goldfield has been made public. It is decidedly deprecatory of the action of the mine owners and the Governor of Nevada and disguises but slightly the opinion that the call for Federal troops was a put-up job to carry out a reduction in wages. Unfortunately the sequence of events lends color to this belief, although the strike which precipitated matters was not over wages. However, the mine-operators considered evidently that since there was to be trouble they would best throw off their thraldom *in toto*. In doing that they went too far and in black-listing the members of the Western Federation not only ignored the sound principle of the open-shop, but also broke a law of the State. In this their action was reprehensible and it is gratifying to report that they have since receded from their false and illegal position.

There are few, however, who will look so leniently upon the past actions of the members of the miners' union at Goldfield as do the Presidential commissioners. In reading their report the historians of the future will derive the impression that Goldfield was a fairly law-abiding place, with only sporadic cases of violence such as are experienced in all mining camps. The evil of high-grading and the inability of the operators to check it are but lightly touched upon. In fact, the report is rather an indictment of the operators than of the miners.

In the meanwhile, the President has consented to allow the Federal troops to remain until April 1, and the State of Nevada, by nearly unanimous vote of the Legislature is organizing a police force, of which the details are reported elsewhere. It is to be hoped that this will work satisfactorily, but there is some skepticism respecting it. As to the mines, the latest report is that over 700 men are at work in them and conditions are rapidly returning to the normal. This shows the advantage of preserving law and order, which certainly has been secured by the presence of the Federal troops.

THE ATTENTION OF manufacturers of safety devices, especially those which are applicable in mining and metallurgical work, is called to the exhibition to be held in New York early in April, details of which will be found elsewhere in this issue. The American Museum of Safety Devices and Industrial Hygiene is a highly praiseworthy organization, which is doing important work in promoting the welfare of American industries by assisting in reducing the frightful number of accidents, fatal and otherwise, which occur in them. Manufacturers of safety lamps, breathing apparatus, safety devices for handling explosives, and all the things which promote safety in mining and metallurgical work are recommended to give attention to this forthcoming exposition. Mining engineers and mine operators will find it worth while to study these exhibits.

OUR FRIENDS WHO favor us with contributions are requested always to put their names and addresses on the manuscripts. Occasionally we receive manuscripts without name or address, or accompanying letter, or anything to indicate their source. Under these circumstances, we are, of course, unable even to acknowledge the receipt of them. This will explain our failure to reply to some correspondence.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Negative Results in Pyrite Smelting

Well! Every one says I am wrong; therefore I must be wrong. I have carefully read all the friendly criticisms in the JOURNAL to date, and now regret that I did not make the original article fuller. In an endeavor to make a short cut and also to save valuable space, the original calculations for the first test charges or their constitution were not given, assuming (I now think somewhat erroneously) that credit would be given for making a proper start. It did not then seem necessary to publish the minute details of the work of those who employed me. All this matter was therefore cut out by saying: "Each test was carefully planned, . . . , slag and matte fall calculations made, etc., etc." As so much interest has been displayed in the matter and so much useful information is being brought out by the discussion, I will make a clearer statement of the work.

PERCENTAGE COMPOSITION OF THE MATERIALS USED IN THE TESTS.

	Silica	Iron	Alumina	Lime	Magnesia	Manganese	Sulphur	Copper	Nickel
Green Ore	10.10	44.68	6.85	1.19	1.14		27.48	1.77	5 62
Quartz (Average)	88.00	8.00	4.00						
Converter Slag	29.09	42.80	8.09	.41	.82		2.24		
Tennessee Mixed Ores	14.30	37.74	6.45	5 65	1.10	.77	27.03	2.17	

The Tennessee analysis is the calculated analysis of a mixture of two-thirds Burra, one-third Polk county, and one-third London mine ores. The green or raw ore was figured for 4½ to 5 into 1 concentration, equal to about a 35-per cent. matte.

The slag was to contain 34 per cent. silica and 55 per cent. iron oxide, with 10 per cent. other bases. The size of the furnace has been stated in the original article. The amount of positive blast, furnished by blowing engines, was varied from 17,000 to 20,000 cu. ft. per minute, while the pressure varied from 16 to 32 oz. and even higher, according to the condition of the furnace.

COMPOSITION OF THE CHARGE FED IN THE FIRST FOUR TRIALS.

	I	II	III	IV
Green Ore	9000 lb.	6000 lb.	6000 lb.	6000 lb.
Quartz	2100	1050	1410	600
Converter Slag			2000	
Coke	440	250	750	528
Coke, Per Cent.	4	3½	8	8
No. of Charges Fed	12	5	7	11
Length of Time of Feeding, Hours	2½	1⅓	1⅘	2 1-12

RESULTING SLAG ANALYSIS AND MATTE ASSAYS.

SLAG				
Silica	35.40	42.25	40.28	32.55
Iron Oxide	49.82	40.89	37.93	42.81
Alumina	8.22	8.22	9.72	13.00
Lime	1.30	2.60		3.84
Magnesia	1.30	3.95		5.75
Copper	.09	.05	.06	
Nickel	.22	.39	.17	
MATTE				
Per Cent Copper and Nickel	12.45	14.50	18.07	14.40

The apparent increased concentration in III was due to the copper and nickel in the converter slag. It was also run on a lower blast.

During the first four tests the following conditions were thought to interfere: Filling the furnace, too rapidly with cold materials; charge, too large; quartz, in too large pieces; quantity of blast, too great, chilling the furnace; lack of sufficient heat at commencement of feeding to start the smelting properly; coke, wet and containing ice and snow; too much quartz for the amount of iron oxidized.

After all these possible causes had been eliminated or tested out, the results, so far as oxidation was concerned, showed no improvement. The calculation was then made resolving the ore into its component minerals (see original article). From the result of this and working upon the assumption that the cause of the difficulty lay in the nearly infusible aluminous residue left after the disappearance of the more fusible sulphides, a number of tests were made for the purpose of fluxing or washing this residue or gangue through the furnace. The coke was purposely kept low so as to get as much of an oxidizing effect as possible.

THE QUESTION OF HEAT

It is unfortunate that Mr. Wright worked out his heat balance from the later tests, which are admittedly erratic, instead of taking what should have been a proper charge for an ore of the analysis given, and basing his figures on that as Mr. Grabill did.

In the eight tests made on ore there was no variation in the action of the furnace and the mode of its freezing (see original article), only a variation in the length of time. The longest run, the seventh, was of seven hours' duration, during which 34 charges were fed, of the following composition: green ore, 6000 lb.; converter slag, 2000 lb.; limestone, 560 lb.; coke, 510 lb., or 6 per cent.

The run was closed by a breakaway under the spout though the furnace was in fair condition at the time of stopping. The matte kept steady between 14 and 15 per cent. copper and nickel. This mode of working, however, was neither a pyritic nor a commercial success.

The prime fact is that the furnace failed to oxidize at any time a proper quantity of the mixed sulphides during the time of its passage from the point of fusion to the slag spout. I have said that practice and theory indicated that an ore of the analysis given should be capable of being treated by pyrite smelting. Exception has been taken to this, and for that reason the Tennessee ore analysis was appended for the sake of comparison. Aside from the splendid published yearly reports of the work, I had the pleasure of being at the smelter of the Tennessee Copper Company a number of weeks in 1904 and know that the mixture of the analysis given was successfully treated.

The heat value is certainly in the Canadian ore. The analysis of this ore indicates only two disturbing factors. One known, i. e., the rather large though not excessive amount of alumina present; and one unknown, i. e., the nickel and its action in an oxidizing furnace. Does it or does it not exert a resistant effect in the oxidation of iron sulphide?

WHY DID IT FAIL TO OXIDIZE?

On ore the furnace certainly failed to oxidize or make a concentration of more than two into one. The cause lies between three points, viz., the action of the nickel under the conditions set forth, and of which, as yet, little or nothing is known; the action of the alumina in raising the formation point of the slag above the temperature furnished by an oxidizing smelting; or, failure to raise the temperature of the mono- or sesqui-silicate slags to a point where it would dissolve the more difficultly fusible gangue rock,* which is almost the same thing.

The gangue of the Sudbury nickel ore is a norite or diorite or some altered

*See "Pyrite Smelting," page 221.

product of one of these two rocks. The norite is composed of a plagioclase, hypersthene, diallage, and sometimes enstatite; or, when partly altered, of plagioclase and bastite. The diorite is composed of a plagioclase and hornblende with a little quartz. The gangue is therefore a bi-silicate or above. It will be noted that the most acid slag made, No. II, was just on the sesqui-silicate mark; Nos. I and III were below the secqui-silicate mark, while No. IV was a mono-silicate. The pyrite furnace selects its slag of the lowest formation temperature from the material available rejecting all excesses.

In the case of alumina it is not possible to carry much above 7 per cent. in a pyritic slag. In the case in question it would have required the early oxidation of all the iron not required for the proper matte fall plus the necessary silica to have diluted the alumina down to the required 7 per cent. of such slag. There was no such early oxidation of the requisite quantity of iron soon after changing the charge from one class of smelting to the other. Every moment's delay, therefore, in the setting up of the proper oxidation coupled with the running off of the melted sulphide, added to the amount of the aluminous gangue that had to be dissolved and removed when such oxidation should be perfect. The one condition never overtook the other and the furnace filled with residual rock.

EFFECT OF THE NICKEL

As to the other point, the nickel:—Did the nickel sulphide liquate in the sense that I used it? It certainly seemed to. There were no data at hand to show that the nickeliferous pyrrhotite did *not* have a lower melting point than a similar mineral without it. It certainly appeared, from observations made of the nickeliferous matte in various stages of treatment about the works, that it remained liquid longer and at lower temperature, as indicated by color, than corresponding grades of copper matte. From these observations the inference was drawn that it had a lower fusion temperature.

I note Prof. Hofman's letter to Mr. Hixon on the subject of the fusibility of the Tennessee and Canadian pyrrhotites. It certainly controverts my assumption as to that point.

Does the nickel interfere with the oxidation of the mixed sulphide? *Quien sabe?* No amount of coaxing seemed to make it oxidize when smelting ore. Mr. Hixon has had the same experience. The matte oxidizes readily enough when subjected to a concentration smelting, also the matte is bessemerized as a regular part of the existing method of treatment to raise it to the grade demanded by the refiners.

Nickeliferous matte has an affinity for or corrosive effect on metallic iron such as cupriferous matte does not possess. About the furnace and settlers all ironwork has to be protected with chrome brick linings. No slag spout can be made that will stand on the furnace discharge. A chrome brick sump takes its place. Small leaks of matte between the steel jackets have to be stopped immediately, or they will perforate the plate and an explosion will result. There are many peculiarities about the matte that differentiate it from copper matte.

A few words to answer some of the other points suggested: As to freezing up and cleaning out:—The market and the refiner were driving the plant for product; therefore, allowing from 18 to 20 hours for a complete freeze up and clean out was out of the question, when three to six hours' nursing (fluxing out the silica and rock residue) would recover the furnace. This experience had been gone through many times elsewhere, and reliance had to be placed on past knowledge gained in this way.

To those who made suggestions as to how the ore could be smelted, I would say that, so far as simple fusion was concerned that was not what was sought. The point was to establish an oxidizing smelting that would cheapen the existing method by cutting out the heap roasting, a process that is theoretically wrong, to say the least.

I appreciate Dr. Carpenter's compliment.

G. F. BEARDSLEY.

Fruitvale, Cal., Jan. 18, 1908.

Silver-Lead Mines of the United States

Where can I procure a list of the dividend-paying silver-lead mines in the United States, giving in as much detail as possible the capitalization, production and gross and net earnings in 1906 and 1907?

F. W. HEUSTIS.

Boston, Mass., Jan. 22, 1908.

The chief producers of silver-lead ore in the United States are the following:

Federal Mining and Smelting Company, Wallace, Idaho.

Bunker Hill & Sullivan Mining and Concentrating Company, Kellogg, Idaho.

Hecla Mining Company, Burke, Idaho.

Hercules mine, Burke, Idaho.

Silver King Mining Company Park City, Utah.

Daly-West Mining Company, Park City, Utah.

Daly-Judge Mining Company, Park City, Utah.

Western Mining Company, Leadville, Colo.

Silver-lead ore is produced by many small companies in Colorado, Utah, Nevada, Idaho, Montana and other States of the Rocky mountains, but the producers of the Coeur d'Alene and Park City are by far the most important.

The capitalization and dividend payments of the above companies (except the Western Mining Company, which is a close corporation), may be found in the table published in the JOURNAL, in the first issue of each month. The other data requested are not completely available.

Full data as to the Federal Mining and Smelting Company will be found in the JOURNAL of January 4, 1908. The Bunker Hill & Sullivan Mining and Concentrating Company in the fiscal year ending May 31, 1907, mined 336,630 tons of ore, from which the smelter returns were $3,293,157. The operating profit was $2,627,778, and the dividends paid were $2,340,000. In the previous year this company mined 347,350 tons of ore, yielding $2,981,834, from which the operating profit was $2,375,263. The dividends paid in this year were $3,480,000. The Daly-West Mining Company in 1904 sold ore to the value of $1,804,673, and paid $1,044,000 in dividends. In 1905 its production was $1,234,459, and dividends $432,000. Its production of lead in 1904 was 12,826 tons and in 1905, 8,386 tons. Other data respecting these companies are not immediately available.

The Moffat Road and Mining in Routt County, Colo.

Placer work by dredging and other means has been greatly stimulated recently in Routt County, Colo., by the assurance that the Denver, Northwestern & Pacific Railroad will be completed within the next three or four years from Denver to Salt Lake City. About 150 miles of the road are already in operation; and it is expected that during the present year it will be completed to Steamboat Springs. From that point for more than 100 miles the line will follow the Yampa and other streams and valleys, with frequent coal and placer-gold deposits.

Several gold dredges are already in operation with good results, and with the advent of the railway others will be installed. But the greatest wealth of Routt county will doubtless be found in its extensive coal deposits; some of the veins are 40 feet or more thick. At present, the county, the largest in Colorado, is an immense stock range, one of the most extensive in the United States.

W. C. FITZSIMMONS.

Cleveland, Ohio, Feb. 4, 1908.

On the Rand, South Africa, the gold, according to R. A. F. Penrose, Jr. (*Journal of Geology*), is finely disseminated in the ore and is rarely noticeable to the naked eye, though it can sometimes be seen in thin flakes incrusting the pebbles, or in small particles in the silicious matrix.

New Publications

THE CHEMICAL TRADE DIRECTORY OF CHEMICAL MANUFACTURERS, MERCHANTS, BROKERS AND AGENTS AND MAKERS OF CHEMICAL PLANT IN GREAT BRITAIN AND IRELAND, 1907. Third edition. Pp. 327. 6x9½ in.; broad covers. London, 1907; Davis Brothers.

This is a thoroughly revised edition of a useful directory, the scope and purpose of which is expressed in its title. The arrangement adopted is a convenient one, and the addition of a classified list, or index, makes it easy to find any particular manufacturer, or all the manufacturers of any special chemical product.

SHAFT SINKING UNDER DIFFICULT CONDITIONS. By J. Riemer. Translated by C. R. Corning and Robert Peele. Pp. 176; illustrated. 6x9 in.; cloth, $3. New York, 1907: John Wiley & Sons. London: Chapman & Hall, Ltd.

SHAFT SINKING IN DIFFICULT CASES. By J. Riemer. Translated by J. W. Brough. Pp., 122; illustrated. 6x9 in.; cloth, $3.50. London, 1907: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company.

These are translations of the same work, which deals exclusively with recent practice in Germany. It is a valuable contribution to technical literature inasmuch as there is comparatively little on this subject in English. The fact that it impressed both English and American translators as being worthy of publication in English is a good indication of its value. Mr. Brough has added to his translation a bibliography of recent papers on shaft sinking. Both the translations are good and we hesitate to express any opinion as to their comparative merits.

THE FIRE ASSAY OF GOLD, SILVER AND LEAD IN ORES AND METALLURGICAL PRODUCTS. By Leonard S. Austin. Pp. 88; illustrated. 6x9 in.; cloth, $1. San Francisco, 1907: *Mining and Scientific Press.*

Contents. The fire assay of ores or furnace and mill products containing gold, silver and lead. Sampling and preparation of the ore for assay. Care of the assay office. Apparatus. The assay furnace. Crucibles and scorifiers. Assay balances. Fluxes used in assaying. Ores. The scorification assay. Cupelling. Parting. The crucible assay. Roasting of ores. Assay of matte. High-grade silver-sulphide assay. Assay of cyanide solutions. Assay of base bullion. Assay of silver bars or ingots. Assay of blister or pig-copper containing silver and gold. Assay of gold bullion. Assay of ores containing metallics. The lead assay.

It is difficult to discriminate in reviewing a work on assaying without subjecting the recommendations of the author to practical trial. We shall therefore confine ourselves in the present case to the statements in the author's preface. He presents a system intended to cover determinations of gold, silver and lead according to methods commonly recognized in the Rocky mountains, and it has been his aim to carry through a single system, which while not the only one would be at least definite and clear to the learner. Professor Austin has had long and comprehensive experience, first as a metallurgist in practice and more recently as a teacher, and the reader may be sure of the practical value of any of his contributions to technical literature.

SIXTEENTH ANNUAL REPORT OF THE ONTARIO BUREAU OF MINES, 1907. Part I. Pp. 248; illustrated. 6½x9½ in.; paper. Toronto, Ont.; L. K. Cameron, King's Printer.

In view of the attention which has lately been attracted to the mining resources of Ontario and the large amount of American capital invested in this continually enlarging field, this document will be found of special interest and value to a large class of readers, as embodying the latest results of investigation and many carefully prepared data in relation to the industry. It embraces a statistical review covering the year 1906, the figures of which appeared some time ago, though slight corrections have been made. The total value of the mining and metallurgical output for that year is placed at $22,388,383, instead of $22,221,808 according to the earlier statement. The operation of the aids adopted by the provincial government for the promotion of the mining industry, including the supplying of government diamond drills, the provincial assay office, and the holding of summer mining classes is fully set forth, and a brief statement of the principal amendments made to the mining laws by the Mines Act of 1906 is given, together with the boundaries of the mining divisions then established. A report by E. T. Corkill, provincial inspector, as to the condition and operations of working mines contains much useful information. The larger portion of the volume is devoted to special papers, based upon investigations and research, descriptive of mineral areas or branches of the mining industry. These include articles by C. W. Knight on "Oil and Gas in Kent"; by Dr. A. P. Coleman and E. S. Moore on "Iron Ranges East of Lake Nipigon"; by E. L. Fraleck on "Iron Pyrites in Ontario"; by R. W. Brock on "The Larder Lake District" and by Willet G. Miller and Cyril W. Knight on "Grenville-Hastings Unconformity."

THE TRANSVAAL AND ITS MINES (THE ENCYCLOPEDIC HISTORY OF THE TRANSVAAL). Edited by L. V. Praagh. Pp. 640; illustrated. 9½x12 in.; leather. London and Johannesburg, 1907: Praagh & Lloyd.

Contents. Historical summary. Constitution and parliament. His Majesty's representatives in the Transvaal Colony. Railways. Ecclesiastical. Transvaal Volunteers. Legal. Ethnological section. Education. Meteorogy. Sport. The zoology of the Transvaal. Game preservation. Botany. Departments of the Commissioner of Lands. Customs department of the Transvaal. Department of Posts and Telegraphs. Transvaal municipalities. Population statistics. Finance and banking institutions. The press of the Transvaal. Pretoria and Johannesburg. The country towns of the Transvaal. The mining industry of the Transvaal. Mining administration. Department of Mines. The foreign labor department. Chinese labor on the Rand. The Transvaal Chamber of Mines. Geological. The Witwatersrand Gold Mines. Outlying mining districts—gold—banket, quartz and alluvial. Diamonds. Base metals and minerals. Coal mining.

The object of this rather pretentious book, according to the preface, is "to create a standing work of reference on the most important of the two South African colonies last added to the Empire. . . . . As far as practicable within the limits of one volume a comprehensive description of the institutions and industries of the Transvaal is presented."

After a historical introduction of 19 pages, there are 65 pages devoted to the government, railroads, churches and other public institutions; followed by 66 pages on the geography, botany and physical features of the country. A section on lands, agriculture and the public departments having charge of them occupies 48 pages, and this is followed by 17 pages of statistical matter. The longest section, 290 pages, is filled by descriptions of Pretoria, Johannesburg and the country towns of the Transvaal. This is full of detailed accounts, not only of public buildings and other matters of general interest, but of individual enterprises, business houses and similar matters. Much of this is rather of an advertising character, and does not add to the value of the book.

The remaining 125 pages treat of the mines of the Transvaal, 50 of these containing general matter on geology, mine administration and similar topics. The gold mines of the Witwatersrand and the outside districts, the diamond mines, other mines and the coal mines are referred to in separate chapters. This part appears to have been compiled with some care, but adds nothing to our knowledge of the mines. It contains some of the usual statistical tables of production, dividends, milling capacity, etc., brought up to the end of 1906.

The book is handsomely printed and is profusely illustrated, chiefly with reproductions of photographs; though there are one or two maps and geological diagrams. A good general map of the colony would be an acceptable addition.

The Nevada State Police

According to the law, adopted by the Nevada legislature Jan. 27, the Nevada State Police is to be composed of a superintendent, appointed by the Governor, one inspector, four sergeants, 25 subordinate officers and 250 reserves. The subordinates are appointed by the superintendent of police, subject to the approval of the Governor. All members and officers are subject to discharge without notice. All members must be citizens of the United States of good moral character, never convicted of a felony, and citizens of Nevada for at least six months prior to their appointment. The members must serve for a period of one year unless discharged or allowed to resign by the Governor. The members must submit to physical and mental examination before appointment.

The members are given not only police power, but also may act as process servers, etc., in any county of the State. Whenever the Governor declares martial law within any county, or counties, the superintendent of the State police has full and absolute power to take all or any steps necessary to preserve law and order. Whenever martial law is declared the rules and regulations of the State police and the rules and articles of war established by Congress become operative.

The superintendent receives $3600 per annum; the inspector, $1500; all other members, except the reserve force, $1200; the reserve force $20 per month when not in active service and $5 per day when engaged in active service. The reserves are subject to call at any time. All members are subject to rigorous rules of conduct and in times of martial law are subject to court martial.

The legislature appropriated $150,000 to pay the salaries and expenses necessary to establish this State police.

To strengthen further the power of the State police two additional laws were passed. One gives to the attorney general power to take charge of the district attorney's office when in his opinion it is necessary or when requested by the Governor to do so; the other law authorizes him to appoint deputies to do the same work.

Exhibition of Safety Devices

Announcement has just been made that an exposition of two months will be held early in April in New York, under the auspices of the American Museum of Safety Devices and Industrial Hygiene, for showing the best methods of safeguarding workmen and protecting the general public. The exhibits will consist of safety devices, protected machinery in actual operation, models and photographs. During the exposition illustrated lectures, by engineers, will explain industrial conditions and hazardous occupations and the most approved methods of safety.

Believing that many accidents are preventable and to stimulate further invention, three solid gold medals are offered for the best safety devices in the field of transportation, mining, motor vehicles and motor boats. Two prizes of $100 each, one for the best essay on "The Economic Waste due to Accidents," the other on "The Economic Waste due to Occupational Diseases" are offered.

The chairman of the Committee of Direction is Charles Kirchhoff, and of the Committee of Exhibits, Prof. F. R. Hutton. There will be no charge for space. All inquiries and applications for space should be made to Dr. W. H. Tolman, at the Museum, 231 West 39th street, New York.

New York & Honduras Rosario Mining Company

The report of the New York & Honduras Rosario Mining Company for the fiscal year ending Sept. 30, 1907, states that during this period 923,538 oz. silver and 11,950 oz. gold were produced, having a total value of $791,347. This bullion was produced from 28,098 tons of dry ore, at a total cost of $18.568 per ton crushed. Of this total, $9.34 was absorbed in mining and $5.82 in milling; the remainder was expended for tramming, cleaning and for surface work.

In his annual report President Valentine calls attention to the appointments of Joseph M. De Hart as general agent and E. A. Nis as general superintendent. He also states that continued development has laid bare larger ore reserves and that the general condition of the mine is good.

The report continues as follows: "A general cut in wages of about 15 per cent. was made. This resulted in a strike lasting only two days, when the full number of men was again at work at the reduced scale. As a partial compensation for the above, the company opened a store with a plentiful stock of eatables, working clothes, etc., which is being sold to the employees at prices far below those charged by the merchants, but with a small margin of profit. At the same time, a company-kitchen was established, where the laborers could board at much lower rates than charged in the town. Mule freight rates were also materially reduced.

"As a result of the above, our working charges have been reduced from 44.68 pesos per ton ($29.66 U. S. currency), in 1906, to 42.20 pesos per ton ($28.57) in the year just passed."

Development during the year comprised 8097 ft. of drifting, 1351 ft. of crosscutting, and 1227 ft. of raises; total 10,675 ft.

The treasurer's report shows liabilities amounting to $2,776,751, consisting of $1,500,000 capital stock; bills and loans payable, $80,435; surplus account, $1,196,316. Against this are fixed assets of $2,174,877 and floating assets of $601,874.

During the fiscal year 11 dividends, amounting to $210,000 or 14 per cent. of the capital stock, were paid.

British Iron Trade in 1907

The exports of iron and steel, and of machinery, from Great Britain for the full year are valued by the Board of Trade returns as below:

	1906.	1907.	Changes.
Iron and Steel.	£39,840,595	£46,661,848	I. £6,821,253
Machinery.....	26,771,889	31,763,524	I. 4,991,635
New Ships.....	8,644,171	10,023,317	I. 1,379,146
Total	£75,256,655	£88,448,689	I. £13,192,034

The more important items of iron and steel exports were as follows, in long tons:

	1906.	1907.	Changes.
Pig iron.....	1,662,820	1,947,925	I. 285,105
Wrought iron.....	200,182	211.771	I. 11,589
Rails.....	460,328	433,638	D. 26,690
Wire.....	95,065	101,555	I. 6,490
Plates.....	275,045	300,590	I. 25,545
Sheets.....	442,414	469,329	I. 26,915
Steel shapes.....	226,230	338,716	I. 112,486
Pipes and fittings....	300,074	349,459	I. 49,385
Other sorts.....	1,020,042	1,013,383	D. 6,659
Total.....	4,682,200	5,166,366	I. 484,166

The larger exports to the United States in 1907 were 439,437 tons pig iron, an increase of 128,738 tons; 58,920 tons of tinplates, a decrease of 2598 tons from the preceding year.

Imports into Great Britain for the year are valued as follows:

	1906.	1907.	Changes.
Iron and steel.	£ 8,359,752	£ 7,215,179	D.£1,144,573
Machinery....	5,126,972	5,311,978	I. 185,006
Total.....	£13,486,724	£12,527,157	D.£ 959,567

The leading items of iron and steel imports were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	90,854	104,778	I. 13,924
Wrought bars.....	107,713	80,355	D. 27,358
Steel ingots, etc.....	486,029	327,207	D. 158,822
Steel shapes.....	138,660	88,905	D. 49,755
Other sorts.....	392,476	334,216	D. 58,260
Total tons.....	1,215,732	935,461	D. 280,271

The greater part of the imports were in raw or semi-finished forms.

Imports of iron ores for the year were, in long tons:

	1906.	1907.	Changes.
Manganiferous ores..	309,071	293,654	D. 15,417
Iron ores.....	7,514,013	7,345,280	D. 168,733
Total.....	7,823,084	7,638,934	D. 184,150

Of the imports in 1907 Spain furnished 239,845 tons of manganiferous ores and 5,472,645 tons of iron ores.

Chromium prepared in an electric furnace was found by Moissan to be slightly soluble in molten copper and investigations of this fact led to the discovery of a new form of chromium, described in the *Revue d'Electrochimie*. This new form is crystalline, has a density of 7.1 and is chemically active; it burns with a bright flame when heated alone in the air and is attacked even by nitrogen at a red heat.

Personal

Mining and metallurgical engineers are invited to keep THE EGINEERING AND MINING JOURNAL informed of their movements and appointments.

W. E. Burlingame, of Denver, Colo., is on a trip to Mexico City.

M. B. Moral, of Peru, is in Guerrero, Mexico, on professional business.

S. S. Murphy, of Denver, Colo., is in Mexico on professional business.

W. Broderick Cloete, of London, is in Mexico, attending to his mining interests.

W. B. Preston, of the Denver Fire-Clay Company, is on his annual trip to Mexico.

A. H. Brush, of Los Angeles, Cal., is examining mining properties in Oaxaca, Mexico.

John Hallen, of Pocatello, Idaho, is making a round of the mining camps of Mexico.

J. G. Gilbert and F. A. Duncan, of Seattle, are in Mexico, on mining business.

H. M. Rodgers, of Washington, D. C., is investigating mining properties in Guerrero, Mexico.

James A. Pollock has been re-elected president of the Salt Lake Stock and Mining Exchange.

W. H. Austin, of Chicago, is looking after mining properties in which he is interested in Mexico.

Fred E. Weston, mining engineer, of Mexico City, is on a three months' trip to Ecuador, South America.

Dr. James Douglas, who is now in Arizona, is expected to return to New York soon after the middle of February.

Wm. Muth, S. L. Smithers and R. C. Wallace, of Helena, Mont., are visiting the various mining camps of Mexico.

George Crerar has been appointed manager of the Takilma Smelting Company, at Takilma, Josephine county, Oregon.

Harvey E. Rice has been appointed superintendent of mills by the Dominion Iron and Steel Company, Sydney, Cape Breton.

P. Haviston, of the Cobalt Consolidated Mines Company, Cobalt, Ont., has returned to Toronto after several months' absence in Europe.

Schuyler Lawrence has taken charge of the Arosco Mining Company's properties, near Urique, Chihuahua, Mexico, for Philadelphia owners.

W. E. Eells, assistant manager of the San Luis Potosi smelter, has returned to Mexico, after a prolonged trip to the States for the benefit of his health.

Major Vereker, who is largely interested in gold properties in the Manitou Lake area in Ontario, is making an inspecton of them preparatory to a trip to England.

Lewis T. Wright, general manager of the Mountain Copper Company, San Francisco, sailed for England on the "Lusitania," Feb. 8. His visit abroad will be brief.

Erich Koischwitz has taken charge of the new office established by Dr. C. Schutten, of Calcutta, at Nagpur, the center of the most important manganese district in India.

W. C. FitzSimmons, of Cleveland, Ohio, has lately returned from a six-months' tour of professional service in the gold-dredging fields of Routt county, Colorado.

George O. Bradley has been tendered the position of manager of the Pittsburg Silver Peak mines at Silver Peak, Nev. He is now chief engineer of the Utah Copper Company.

Lindon W. Bates has resigned as president and director of the Empire Engineering Corporation, New York, and Wm. Barclay Parsons, always a director, has been elected president in his place.

A. A. Hassan, mining geologist and consulting engineer, of Brooklyn, N. Y., has severed his connection as consulting geologist and mining engineer for the Bishop Creek Gold Company, of California.

Richard S. McCaffrey has resigned as manager of the Salt Lake Copper Company and has accepted the position of superintendent and metallurgist of the Tintic Smelting Company, which has a lead smelter under construction in the Tintic district, Utah.

L. P. Ross, late manager of the Cranberry Furnace Company, at Johnson City, Tenn., has been appointed general manager of the Northern Iron Company, at Standish, N. Y. His successor at Cranberry Furnace is E. P. Ross, recently manager of Rockhill Furnace, in Pennsylvania.

Obituary

All who are connected with the iron and steel trades will regret to learn of the death of Mrs. Ellen W. Fritz, wife of the venerable John Fritz, which occurred at Bethlehem, Penn., Jan. 29. Mr. Fritz is regarded with such universal respect that his bereavement will cause a general expression of sympathy.

George Crismon, for many years president of the Utah Mine Company, operating at Fish Springs, Utah, is dead from the effects of a paralytic stroke. He was a Utah pioneer and when the Union Pacific railroad was built the deceased and a brother were awarded a large share of the grading contracts between Green River, Wyo., and Ogden.

Judge Thomas Mellon, for many years prominent in Pittsburg as a lawyer and afterward as a banker, died in that city, Feb. 4, aged 95 years. He was interested in important business interests aside from banking, having been one of the leading men in founding the Aluminum Company of America, the Carborundum Company, the Georgia Bauxite and Mining Company, the J. M. Guffey Petroleum Company, the Gulf Refining Company and the Union Steel Company. The last named is now owned by the United States Steel Corporation.

William J. Seaton, Jr., second vice-president of the C. W. Hunt Company, West New Brighton, N. Y., died at his home at Clifton, Staten Island, on Jan. 18, from typhoid fever, at the early age of 36 years. Seventeen years ago he entered the employ of the C. W. Hunt Company as a boy, but his exceptional abilities soon gained for him deserved promotion. At the time of his death he was holding office as a vice-president of the company. His name was associated with many of the large contracts carried out by the company in recent years.

John S. Dougherty died at Anaconda, Mont., Jan. 28, aged 55 years. He was born in Pennsylvania and when a young man went to Michigan, where he was engaged in copper mining for a number of years. About 1887 he went to Montana and settled in Butte where he was in charge of the Parrot smelting works. Later he went to the reduction works at Anaconda where he was superintendent for 14 years. He retired from this position and settled on a ranch in the Big Hole valley, near Corvallis. Two years ago, however, he returned to Anaconda, and was engaged in several mining enterprises.

Societies and Technical Schools

Columbia University—The December number of the *Columbia University Quarterly* is devoted largely to interesting descriptions of the schools of mines, engineering and chemistry. A history of the school of mines is contributed by Professor C. F. Chandler, and is accompanied by some excellent illustrations. An interesting introductory article by Charles B. Going is on "The Relations of Technical Education to Industry."

American Institute of Electrical Engineers—The annual dinner of the institute will be held at the Waldorf-Astoria, New York, on the evening of Feb. 19. Carrying out the idea established upon former occasions, the feature of the dinner this year will be the tribute rendered by the speakers to the relation of the electrical engineer with public service corporations. The occasion will be designated as the "Public Service Dinner," and among the speakers who have promised responses to toasts are many men prominently identified with public service utilities, either as members of commissions, or operating heads of large utilities organizations.

Stevens Institute—The seventh annual dinner of the alumni of Stevens Institute, Hoboken, was held at the Hotel Astor, New York, on Tuesday evening, Feb. 4. About 250 Stevens men and their friends were present, and besides enjoying the usual features of a college dinner and reunion, they heard some notable addresses, among the speakers being Pres. Alex. C. Humphreys, Dr. H. S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching; Hon. Robert P. Porter, formerly chief of the Census Bureau; Col. George Harvey; James E. Sague, of the New York Public Service Commission; Col. Charles W. Fuller, Prof. George V. Wendell, Ernest H. Peabody and H. V. R. Scheel.

Association of Licensed Cement Manufacturers—This association was organized in New York Jan. 9 by the North American Portland Cement Company, the Atlas, Alpha, American, Lehigh, Lawrence, and Vulcanite Portland cement companies, and various other important companies in the East and West, including the Dexter, Edison, Nazareth, Pennsylvania, Penn-Allen, and Catskill, all of which have secured licenses under the Hurry & Seaman, Edison, Carpenter, and other patents controlled by the North American Company. Other applications for membership have been presented and are under consideration. The officers of the association are A. F. Gerstell, president; Conrad Miller, vice-president; Alfonso De Navarro, secretary and general manager. The purposes of the association include the general betterment of the mechanical and chemical processes used in making cement, the improvement of the quality of cement, dealing with matters of traffic and shipment and the establishment of an association laboratory for technical tests and experiments. It is understood that all existing and properly equipped cement plants will be granted licenses and admitted to membership. Infringers of the patents above referred to will be rigorously prosecuted. Nearly 70 per cent. of the output of the Portland cement industry in this country is already represented in the association.

Industrial

The new blast furnace of the Ironton Iron Company, at Ironton, Ohio, is nearly completed, and will go into blast this month.

The Shenango Furnace Company has abandoned its old No. 2 furnace at Sharpsville, Penn. Its new No. 2 furnace will be ready for the blast early in March.

The Northern Electrical Manufacturing Company, Madison, announces the removal of its St. Paul office to the Endicott building. T. E. Drohan is in charge of the new office.

The contract for building a new blast furnace for the Brier Hill Iron and Coal Company at Youngstown, Ohio, has been let to the Wm. B. Pollock Company, of Youngstown, work to be begun in March.

The Sullivan Machinery Company announces that Mr. George M. Bertram, for several years connected with the company, is appointed local manager of its Joplin, Mo., branch office, succeeding Mr. Randolph D. Talmage.

The United Steel Company, Canton, Ohio, has just secured a contract from a Detroit automobile manufacturer for 2000 tons of vanadium steel. It is said to be the largest order for vanadium steel ever placed in the United States.

Robert W. Hunt & Co., of Chicago, have established their St. Louis office, which is in charge of C. W. Gennet, Jr., at 1445 Syndicate Trust building. They have arranged to locate their chemical and cement laboratory in the same building.

The Kittanning Iron and Steel Company, of Kittanning, Pa., blew out its old Rebecca furnace on Dec. 19 and is now dismantling it. The stove equipment of the old furnace will be used in operating a new stack which the company is building.

The Lehigh Iron and Steel Company, of Allentown, Penn., has abandoned its No. 2 furnace and the stack is being dismantled. It was completed in 1872. The company may also dismantle its No. 1 furnace, which was completed in 1869. Both have been idle for several years.

The Allis-Chalmers Company, Milwaukee, Wis., in addition to the 12 gas-engine-driven blowers it is building for the Carnegie Steel Company's Homestead plant and the new works of the Indiana Steel Company, at Gary, Ind., has on its erecting floor at West Allis large vertical steam blowing engines for the Wickwire Steel Company, Tonawanda Iron and Steel Company, Pennsylvania Steel Company and Republic Iron and Steel Company.

In accordance with the usual custom, the H. W. Johns-Manville Company held a convention of its branch managers, in New York, from Jan. 29 to Feb. 1. The managers of the various branches of the company throughout the United States were present at the meeting and a general discussion of the business affairs of the company took place. As a wind-up of the convention a banquet was given to the managers at Union League Club on Friday evening, Jan. 31.

At the annual meeting of stockholders of the Harbison-Walker Refractories Company, recently held in Pittsburg, the retiring directors were re-elected with the exception of S. C. Walker, deceased, and W. A. Stanton, resigned. William Walker and N. McQuillen were elected to fill the vacancies. At the meeting of the board H. C. Croft was elected president to succeed S. C. Walker. Mr. Croft had been vice-president of the company, and Hay Walker, Jr., was elected to succeed him in that capacity.

At the annual meeting of the stockholders of the Riter-Conley Manufacturing Company, Pittsburg, builder of iron and steel construction work of all kinds. H. A. Carpenter was elected president; J. Gilmore Fletcher, vice-president and general counsel; W. L. Jack, treasurer, and T. B. Riter, secretary. The resignations of John S. Craig, secretary and treasurer; W. C. Coffin, vice-president, and Robert A. McKean, general manager, were accepted by the board. President Carpenter has been connected with the company for 12 years past.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Smooth-On Manufacturing Company, Jersey City, N. J. History. Pp. 8, paper, 3x6 in.; 1907.

De Laval Steam Turbine Company, Trenton, N. J. Bulletin 501. Steam Turbine Machinery. Pp. 30, illustrated, paper, 4½x7 in.

Jenkins Brothers, No. 71 John street, New York. Gate Valves; Supplement to 1907 Catalog. Pp. 12, illustrated, paper, 5½x8½ in.; 1908.

Rockwell Engineering Company, 26 Cortlandt street, New York. No. 13. Rockwell Portable Heaters for Oil Fuel. Pp. 4, illustrated, paper, 6x9 in.

The Standard Manufacturing Company, Shelby, Ohio. Champion and Standard Double Acting Spring Hinges. Pp. 14, illustrated, paper, 6x9 in.; January, 1908.

American Spiral Pipe Works, Chicago, Ill. Circular No. 21. Spiral Riveted Pipe Forged Steel Pipe Flanges; Hydraulic and Exhaust Steam Supplies. Pp. 18, illustrated, paper, 8x10 in.; 1908.

A. Leschen & Sons Rope Company, St. Louis, Mo. Half a Century of Rope Making. Pp. 88; illustrated. Paper, 8x10 in. This is really more than a catalog; it contains a great deal of information on the making, uses and strength of ropes, their use for hoisting, tramways, haulage and other purposes. There are also directions for splicing; notes on the use and care of ropes, and other information which makes the book convenient for continual reference. It is handsomely illustrated.

Construction News

Platteville, Wisconsin—The Calemesis Mining Company proposes to instal an additional boiler of 100 h.p. capacity; also additional sinking pumps to have a total capacity of 1000 gal. per minute. Walter A. Ennis, Platteville, Wis., is superintendent.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Denver, Spokane, San Francisco and Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 5—At the new camp of Hart, in San Bernardino county, where there is much excitement at present over the gold finds, the rock is very hard and flint-like, different from that with which California prospectors are familiar. In fact the ground has been looked over for some years, but it remained for Goldfield prospectors to realize the value of the rock. Some 200 men started work on leases on the first of this month, and a contract has been let for the daily delivery of 8000 gal. of water at the camp. Thirty-five leases have been let, and the leases on the Oro, the Lee Foster and Goldfield Big Chief are shipping ore. The Todhunter and Aldrich lease has struck pay ore. Hart & Hitt are sacking ore on the original strike. The population of the place is rapidly increasing, as numbers of men continue to come in. Many claims within a radius of two miles have been taken up. A newspaper called the *Hart Enterprise* has been established already by Nevada men. The development work thus far has, of course, been very little, the camp being only a month or two old.

The $75,000 mill and roaster at the Lila C. borax mine, seven miles southeast of Death Valley junction, Inyo county, the erection of which was begun about a month ago, is nearing completion. The building has been erected and the machinery is being put in place rapidly. With this equipment the low-grade ore, which has gone to the dump, will be partly refined and be added to the product of this famous mine, which is now the largest producer of borax in the United States.

The independent oil producers and representatives of the Associated Oil Company met in this city Feb. 2, and it is expected that their deliberations will result in material increase in the price paid by the Associated company for oil. The Associated, with its allies, the railroads, has heretofore been able to dominate the situation. This Associated Oil Company is composed of some 60 separate companies which combined as one a few years ago, and is now the largest seller of petroleum in the State. The "independents" are the companies left out of the combination. These independents control about one-eighth of the output of California, and wish to be paid higher prices. They threaten to put in their own pipe-lines and deliver their own oil at tidewater. The Associated has been paying about 40c. a barrel of late, and the independent men now want 75c. The price will be fixed somewhere between these extremes, and it is expected this will be 50c. per barrel. The Associated buys the oil to sell.

The Los Angeles Chamber of Mines has strongly indorsed the bill of Congressman Englebright for the establishment of a bureau of mines, and it was decided also that Los Angeles offers unexcelled advantages for the establishment of one of the testing plants provided for in the bill. Among other things decided at the recent meeting was that the mining laws of the State are in urgent need of codification and revision, and a resolution was adopted to that effect.

After being closed down for two months on account of being unable to secure cars in which to ship its product, the Standard Portland Cement Company started up its plant at Napa Junction last week.

The shoot of ore in the Idaho-Maryland mine, Grass Valley, struck in the end of the 500 level, 1500 ft. east of the shaft has been opened a distance of 100 ft. and has widened out to 18 in. from a mere knife blade. Enough ore is being taken out to keep 10 stamps running. The ore is not "specimen," but it has good milling value, as good as any in other mines in the district. Out of the Eureka-Idaho shoot, passing into the Maryland, upwards of $17,000,000 was taken during a series of years. When it passed into the Maryland the Idaho was sold to the former company and the two mines combined as one. If the present ledge continues, no more money will be needed from stockholders to develop the property, and there is little danger of the mine being closed down again. The Idaho paid continuous dividends longer than any other mine in California and only had to be given up when, as stated, the rich ore shoot ran into the Maryland ground at the end lines.

A deal which means the merger of the light and power plants of central California has been consummated in this city and a mortgage and deed of trust of $45,000,000 has been made to the Union Trust Company, of San Francisco, from the California Gas and Electric Corporation. This latter company has had transferred to it all the property and franchises of the following companies: Oakland Gas, Light and Heat Company, Oakland Equitable Gas Company, Berkeley Electric Lighting Company, Bay Counties Power Company, Valley Counties Power Company, Yuba Electric Power Company, Nevada County Electric Company, Butte County Electric Power and Light Company, Standard Electric Company of California, Stockton Water Company, Blue Lakes Water Company, Sacramento Electric, Gas and Railway Company, Central Electric Railway Company, United Gas and Electric Company, San Mateo Power Company, and the shares of stock of the South Yuba Water Company. Of $45,000,000 in bonds authorized, the sum of $38,282,000 is reserved for the purpose of refunding the underlying bonds of the companies making the transfer to the California Gas and Electric Corporation. Of the remainder, $3,055,000 of bonds is to be applied to take up the floating debt of the California Gas and Electric Corporation. The bonds will be issued in different denominations for 30 years, expiring in 1937, and bear interest at the rate of 5 per cent. Part of the bonds, to take up the floating debt, will be issued at once.

Spokane, Wash.

Feb. 4—The Syndicated Deep Mines has put a crew of men at work on its properties in the Republic district, Ferry county, Wash., cleaning up for active operations which are expected to begin by the middle of February. The company has decided to sink to a depth of 1000 ft., that heretofore reached having been about 600 ft. Great interest is being shown in this project, on the part of engineers, some of whom assert that there is a great future for the Republic camp if it is mined scientifically and intelligently. A strike of copper ore in the upper level of the Insurgent mine, which adjoins the Syndicated, has recently been made. The pay streak is 20 in. wide, and about 100 ft. long. The ore is now being shipped to the Granby smelter at Grand Forks, British Columbia.

The old Panhandle Smelter Company, which owns a plant of 250 tons capacity, at Ponderay, Idaho, will blow in its first furnace Feb. 15, and its second one on Feb. 20, according to its president, J. Herbert Anderson. The company was re-organized in January under the title of the Idaho Smelting and Refining Company. The Pennsylvania Smelting Company has also become financially interested, and President George Faunce, of that company, will become active manager of the smelter. Although the company owns a number of mining claims, it will purchase its ore from the Cœur d'Alenes, and from the small properties tributary to Lake Pend'Oreille. The re-organization in-

volved a contraction of the capital stock from $5,000,000 to $2,000,000.

A number of properties in the Metalline district, Stevens county, Washington, are now carrying on development work. The Spokane Lead Mines Company has recently rafted down the Pend'Oreille river the last machinery and lumber for its new compressor, which is rapidly nearing completion. This is seriously handicapped by want of convenient and cheap transportation. Concentrates have been hauled a distance of 11 miles to a point above the cañon where they were loaded on boats, bound for Newport on the Great Northern. This has proved expensive, on account of the repeated handling. It is now stated on good authority that a light draft steamer, designed especially for the narrow and dangerous cañon, is being built, and will be put on the run this season. If successful, this will allow of water transportation all the way to Newport.

Denver

Feb. 7—Stratton's Independence mine, which for the last few years has been worked entirely under lease, is now closed down until the mills start in full operation. Two complete mills are in course of erection, one to treat 5000 tons of dump ore per month, the other, 3000 tons of mine ore per month. The mine is a very extensive one, having over 25 miles of levels, most of them opened on the various veins of the Independence group; these veins have been worked very largely in the rich-ore zone, leaving the low-grade ore standing in place. It was evidently the intention of the company to begin stoping these low-grade ores and treat them direct in the new mill, but since mill construction began, a serious cave occurred in the mine, closing down all the main workings from the fifth level to the surface. This was a result, of the usual methods of leasers, which consist naturally in getting the ore as cheaply as possible, without any regard for the future of the mine; they removed pillars and arches in the main stopes, followed the high-grade streaks wherever they went without regard to the future effect on the stope and used little if any timber. This cave will necessitate the opening of some of these lost levels, in order to get at the ore. It appears to be the intention of the management again to lease most of the workings after the ground is selected in which the company will conduct the mining of the low-grade ore to supply the new mill; but it may be a matter of two or three months before leasing operations are again in full swing. It is rumored that there will be more or less delay in the completion of the mill, on account of the great difficulty experienced in procuring the necessary machinery on account of the disorganized condition of various machinery industries of the country, caused by the financial depression.

The production of the Cripple Creek mines in January is stated to be 58,785 tons, with a gross value of $1,336,000, the largest for any month during the last three years.

At the meeting of the Portland Gold Mining Company in Cheyenne, on Feb. 3, the old management was re-elected. The mine during the past year, according to the president's report, produced 70,392 tons of ore, having an average value of $21.75 per ton, and 9567 tons, having an average value of $7.25 per ton; total gross value, $1,600,950. Total net earnings for the year, $553,858.

The Isabella Gold Mines Company also held its meeting at Cheyenne on Feb. 5. and re-elected the old management. Gross receipts from the sale of ore during the past year, $327,354, of which lessees received $78,896. Net profit to the company, $36,103.

The ore in both the Portland and the Isabella mine continues to be equally as rich as in the upper levels and the size of the orebodies does not appear to diminish with depth.

The Golden Cycle mine reports 67,000 tons of ore, having an average value of $21 per ton, produced during 1907.

The president of the Vindicator Gold Mining Company reports that 1907 was the most prosperous year in the company's history; 19,570 tons of ore, having an average value of $41 per ton, was shipped and a net profit of $265,144 was made.

Scranton

Feb. 10—An interesting gathering will be held in WilkesBarre, Penn., on Feb. 12, under the auspices of the Board of Trade, the occasion being the celebration of the 100th anniversary of Judge Fell's discovery of the possibility of burning anthracite coal in a grate. In that time the anthracite tonnage has increased from 150 tons to 22,000,000 per annum. William Griffiths, mining engineer, will read a paper upon the commercial value of Judge Fell's discovery, while addresses will be made upon other features by prominent men in the anthracite industry.

A large body of water was tapped in No. 15 slope, Beaver Brook, this week, by two miners who, while at work in their breast, dug into an old gangway filled with water. The two men were carried bodily out of the breast, but fortunately escaped without injury. The water was kept under control, without stopping the operation.

No. 2 colliery, of the Delaware & Hudson Company, at Plymouth, will resume work next week after many months' idleness for repairs. The same company has completed the work of sinking an air shaft in connection with No. 3 colliery at the same place.

Three men were burned by a gas explosion at No. 2 colliery, of the Delaware & Hudson colliery, Plymouth, last week. Two of the men were walking up the slope with open lights when the gas was set on fire. Fortunately most of the men had gone home at the time, otherwise the results might have been disastrous. Two of the men were fatally injured.

Citizens of Carbondale, at the northern end of the anthracite field, have been compelled to organize for the purpose of protecting their homes from the mine fire which has been burning for the past 50 years. Many expensive efforts have been made at various times to extinguish the flame, but without success, and the fire has reached the stage where the fumes are now carried into the houses, making them uninhabitable. It is feared that all the houses must be vacated unless some drastic steps can be taken to protect them.

Toronto

Feb. 7—The Canadian Geological Survey has undertaken a systematic investigation of the coals of the Dominion, in which sufficient progress has been made to justify the expectation that the main work will be completed by the end of 1908. A representative sample lot of coal will be obtained from each important seam in each district and subjected to an exhaustive series of economic and chemical tests, including washing and when necessary, dry cleaning, followed by boiler tests. It is also proposed to test other portions in gas producers, with devices for measuring the power developed, and to carry out competitive coking tests.

The coöperation of the Mining and Mechanical Engineering departments of McGill University, Montreal, has been secured, thus obtaining the services of a trained staff of experts and the use of well equipped laboratories. The investigation is under the general direction of Dr. J. B. Porter, professor of mining engineering, at McGill University, R. J. Durkey, professor of mechanical engineering in the same institution, is in charge of the boiler and producer-gas tests. The economic tests are to be carried out on a scale of approximately 50 h.p. and for periods of not less than one day.

The samples will be procured by Theodore Denis, of the Survey, who is to visit each mine and select a 10-ton lot of coal. taking every precaution to secure an average sample. So far 19 lots have been secured from the mines of Nova Scotia and New Brunswick, virtually completing the survey of the Eastern section. These samples have all been subjected to the boiler tests. It is expected to be able to cover the Western coalfields this season. Several preliminary samples, including lignite from Saskatchewan and anthracite and bituminous coal from Alberta, have been procured, which are being used in connection with the development of a producer for dealing with fuels of this character.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

PRINCE OF WALES ISLAND

Sulzer Mine—Some shipments of copper ore from this mine have been made to smelters in British Columbia. A bargeload of ore is now on the way to the Tacoma smelter at Tacoma, Wash. The ore is said to average about 6 per cent. copper.

SITKA

Chicagoff Gold Mining Company—A tunnel, which is to be about 700 ft. long, and will cut the ledge at about 170 ft. depth, is being driven under charge of M. Archelganski is superintendent. At a recent meeting in Sitka, the directors declared a dividend of $8000, the first paid by the company.

Arizona

COCHISE COUNTY

Calumet & Arizona—The force of men employed in the Oliver shaft was increased by 70 miners on Feb. 1. More ore is to be shipped to the Douglas smelting works.

PINAL COUNTY

Imperial—The new smelting works of this company at Sasco have been put in operation.

YAVAPAI COUNTY

United Verde—Ten carloads of machinery have arrived for the smelting works and power plant. Three furnaces are at work and the output, which was reduced one-half, has been increased to two-thirds of the capacity. The shaft on the Verde Grande property is down 425 ft. and continues to show sulphides.

Humboldt Smelter—Sufficient funds have been received to discharge all labor obligations of the company, and it is believed that operations will be resumed by April 1.

Arkansas

MARION COUNTY

McIntosh—This mine and mill on Rush creek have been leased to F. Wallace White, of Pittsburg, Penn., for a term of 20 years. The property will be started up soon.

California

CALAVERAS COUNTY

Monkey Wrench—At this gravel mine, Mokelumne hill, Pfortree & Varian are sinking an incline under the lava cap to determine the extent of the channel.

Rattlesnake—This mine at Mountain Ranch, operated by Domenghini & Pillon is yielding rich ore.

Cowbell—Chas. Kucks has purchased this mine at Mountain Ranch from T. J. Ehrart and a force of men is to be put at work.

EL DORADO COUNTY

Stillwagon—A new corporation has taken over this mine at Grizzly Flat and W. L. Rees has been selected as superintendent. Operations will begin shortly.

Collins-Bacchi—Samuel Collins has purchased the interests in this mine near Garden Valley and bonded it to men who expect to put up buildings and start sinking a 500-ft. shaft.

California Mohawk Mining Company—Superintendent D. R. Caldwell has a force of men building a débris dam on Pery creek near Fairplay. The company will commence hydraulicking as soon as the dam is completed to the satisfaction of the California Débris Commission.

FRESNO COUNTY

Chiquita Mining Company—This company has been organized in Fresno to work certain mining claims on the south fork of the San Joaquin river in the mountain region.

INYO COUNTY

Ballarat—Chicago men have bought from John Coy and others a group of claims in Peasant cañon, at this camp, and development operations will be commenced at once.

Brownie—Alfred Stearns in working a small force of men on a lease on this mine at Buena Vista, with promising prospects.

MARIPOSA COUNTY

Pocohontas—The shaft in this copper mine is down 200 ft. The new hoist is in operation and the entire plant nearly completed. On the Great Northern owned by the same company an adit is being driven.

Teddy Jay Mining Company—This company has been organized with W. H. Nessler as president and A. O. Abell, secretary, to work the Teddy Jay mine near Exchequer.

MODOC COUNTY

Fort Bidwell—Miners have been working the ores in arrastras at this new camp, but cold weather has put a stop to this class of work.

MONO COUNTY

Myrtle & Julia Mining Company—At this property, H. H. McCluskey manager, sinking of the shaft will shortly be resumed.

NEVADA COUNTY

Murchie Mining Company—At this property Superintendent Fitter will shortly resume sinking and open up the 1100-ft. level.

Normandie—The Reno, Nev., men who bonded this mine from Frank Dulmaine have installed a steam hoist and pumping plant, and as soon as other machinery is in, will begin sinking.

SHASTA COUNTY

Balaklala—This company will build a converting plant, the contract with the American Smelting and Refining Company, whereby the latter was to treat the Balaklala matte, having been cancelled. It is reported that 80 per cent. of the Balaklala stockholders have agreed to the transfer to the new First National Copper Company.

Ownership of this company is to be taken over by the recently organized First National Copper Company, of which T. W. Lawson is president. The company has been financed so that the construction of the smelter may proceed.

SISKIYOU COUNTY

Adeline Ricks—At this mine, Callahan, the 10-stamp mill is nearly completed, and good ore is coming out of the 4-ft. vein in the mine. It is expected that the capacity of the mill will shortly be doubled.

Golden Eagle—At this mine, Indian Creek, where they are employing a large force of men, two stamps have been added to the mill.

Johnson—At this mine near Oro Fino, G. W. Addison superintendent, the lower adit is nearing the point where it is expected to tap the ledge.

TRINITY COUNTY

Bullychoop—After considerable dissension among the stockholders of this mine, close to the border of Shasta county, the difficulties have been settled, and the mine, which has been idle for some months, will start up again as soon as the snow melts sufficiently for operations to be conducted without too much expense.

Quimby—At this property, New River district, J. A. Brent, manager, the 12 mining claims are being surveyed, and surveys for new ditches and flumes are also being made.

West Point—In this mine, Deadwood, Mark Manley superintendent, an important strike has been made, which insures the installation of a new machinery plant, when the weather permits.

Colorado

Boulder County

Cobalt Find—It is reported that a paying vein of cobalt has been found in Allen's park near Long's peak; Denver men are interested.

Ragtop—This claim at Sugar Loaf has been sold to eastern people for $12,000. Mike Rosenbaum was the former owner.

Clear Creek County

Honest John Mining, Milling and Tunnel Company—This company has purchased the Black Eagle group of claims and the Empire mill site on Chicago creek; it intends to renovate the mill and install an air compressor plant. The office of the company is at Idaho Springs.

Accord Mining and Milling Company—High-grade ore has been found in the adit workings near Georgetown, and new machinery has been recently installed. J. J. Culley, of Georgetown, Colo., is manager.

Sun and Moon—This group near Idaho Springs has been taken under a lease and bond by the Sol Luna Mining Company and arrangements are being made for extensive developments there, as well as from the Newhouse adit. R. C. Bonney, of Idaho Springs, is manager.

Denver County

American Smelting and Refining Company—The Globe smelter has announced a cut in wages, varying from 10 to 20c. per day, to be effective Feb. 11. This reduction in wages affects 700 men. It is rumored that one of the plants at Pueblo will be shut down.

Gilpin County

The shipments of smelting and crude ores, mill tailings and concentrate to Denver smelters and outside points for the past month were 202 cars or 5050 tons; this is an increase of 25 per cent. over any month for 1907, and is the heaviest monthly output during the last 21 months.

Rara Avis—This group in Eureka district has been sold by trustee's deed to L. Sternberger, of Denver, and it is reported that arrangements are being made to start up the property.

Aztec Mines Company—This company, operating the O. K. property on German hill, is to acquire part interest in the Bench mine in Russell district. Men from the East and from San Diego, Cal., are interested. H. Irving Jones is manager.

Gilpin Independence Mining Company—It is reported that this company will purchase a mill or will erect its own stamp mill, near their Golden Flint property in Independence district. O. Q. Beckwith, of Denver, Colo., is manager.

Florida

United Phosphate Company—This company has been incorporated by Henry J. Braker, Benjamin Harris Brewster and Lorenzo A. Wilson. Until the first annual meeting of the company, which will be in Jan., 1909, the officers of the company are to be as follows: President, Benjamin Harris Brewster, Jr., of Philadelphia; vice-president, Henry J. Braker, of New York; secretary and treasurer, Frank Morse Smith; general manager, Lorenzo A. Wilson, of Jacksonville. The directors are to be Henry J. Braker, Benjamin Harris Brewster, Jr., Lorenzo A. Wilson, Frank Morse Smith, Frank L. Wheeler and Frank R. Savidge. The office will be in Jacksonville, Fla. It is said that the company will take over several phosphate properties.

Georgia

Talbot County

A deposit of red hematite is reported found near Woodland, on the Atlantic, Birmingham & Atlantic road, between Manchester and Talbotton. The deposit is apparently of considerable size, and is now being examined by engineers.

Kansas

Zinc-lead District

Ayler Land—Bartlett, Stearns & Cummings have contracted for $10,000 worth of drilling in their lease on the Ayler land, north of Badger.

Hawkeye Mining Company—This company has bought the Kramer-Morse mine and lease near Baxter, and will push work on the property.

Mission—This mine at Baxter has 250,000 lb. of zinc ore and 60,000 lb. of lead ore stored.

Missouri

Zinc-lead District

Bradford-Kansas City Mining Company—This company has sold its property at Centerville, commonly known as the Daylight mine, to a company composed of Joplin men. The original operators retain the fee and lease the mine at 20 per cent. of the zinc and 25 of the lead ore. The mine is the largest producer in the district.

Bumble Bee—This mine, just south of the Joplin city limits, has been re-opened and is now shipping ore. It was formerly a large producer.

Collins—Budd M. Robertson, of Joplin, has bought the Collins estate of 650 acres, northwest of the city. It is considered a valuable property.

Little Princess—This mine at Webb City is being operated at much less expense than before the stringency. The company is installing Cooley tables to work the sludge. These tables are new in this district.

Porter Land—L. P. Benna has made a strike of jack on the Porter land near the Chautauqua grounds in the city limits of Carthage. The drill-hole was near some prospects of 20 years ago; almost solid jack was found from 70 to 80 ft. and good cuttings to 135 ft. Mr. Benna has since leased part of the Chautauqua grounds.

Montana

Edgar L. Newhouse and M. R. Guggenheim, representing the American Smelting and Refining Company, have been in Helena recenty on business connected with the East Helena smelter. It is prophesied by some that a reduction in smelter rates will soon be announced. The Montana Mine Owners' Association is developing into a strong and well-organized body, and is pushing plans for the building of an independent smelter. The next meeting of the Association will be held in Helena on Feb. 17.

Butte District

Original—The work of repairing the shaft has been completed and mining operations have been resumed on the lower levels. New ropes have been stretched over the sheave wheels and the shaft is again in commission. In addition to retimbering at different points between the 200 and 1000-ft. levels, it was found necessary to straighten the shaft in places where it had become twisted from pressure. During the time that the repair work was going on operations completely ceased on the 2000-ft. level, the ore from the levels above being hoisted through the West Stewart shaft, which extends only to the 1900-ft. level. The resumption of operations on the 2000-ft. level will give employment to between 60 and 70 additional men.

East Butte—This company is planning to build a concentrating mill of 500 tons daily capacity.

North Butte Extension—The president of this company, W. T. Van Brunt, of New York, has been in Butte inspecting the workings of the mine and the new surface plant. The shaft is now down 480 ft., 80 ft. having been sunk during the month of January. A great deal of water is being handled.

Lizzie—Jack Hoy and his associates, who are working this claim under lease from the Davis-Daily company, have cut two veins on the 200-ft. level. These

veins both contain commercial copper ore and are the same ones upon which work has been prosecuted on the 100-ft. level.

JEFFERSON COUNTY

Ruby—This mine, which was recently purchased from W. A. Clark by P. F. Dowling, a well known mining man of Jefferson county, has been closed since the smelters in Butte and Anaconda ceased accepting custom ore. Mr. Dowling is now making preparations to resume work in the spring and to operate the mill, which has not been in active use for some years.

Montana Consolidated Copper Company—This company is actively prosecuting development work on its Comet mine, situated a few miles from Basin. A new shaft is also being sunk on the Hope and it is understood that conditions are encouraging.

FERGUS COUNTY

Barnes King—It is reported from Kendall that a strike of commercial gold ore has been made on the property of this company. The report states that miners working on the Santiago property encountered a streak of rich ore and that subsequently it was found that almost the entire orebody was on the Barnes King side of the line.

Gold Link Mining Company—This company will begin operations at Kendall, Feb. 15. A shaft will be sunk on the Saddle claim, where extensive diamond-drill explorations have been carried on.

LEWIS & CLARK COUNTY

Helena—News has been received from Haystack Butte gulch, a short distance from East Helena, of a rich gold strike by Tony Smith, who has been developing the property for about a year.

BROADWATER COUNTY

Tiger—The General Mines Company which owns the Woodland Park mine in the Elkhorn district, has purchased the properties of the Tiger Gold and Copper Company, in Avalanche gulch. The adit, which is now in 440 ft., cuts the vein at a depth of 350 ft., and commercial gold-copper-silver ore has been encountered.

Nevada

ESMERALDA COUNTY—GOLDFIELD

During January the mines of Goldfield produced about 4500 tons of ore. The Combination treated 600 tons of ore and the Kinkead 175 tons during the week ending Jan. 30.

Goldfield Consolidated—About 100 men are grading for the new mill. At the Gotwaldt lease on the Combination No. 2, an electric hoist is being installed. A 12-drill compressor is being installed at the Rosebud lease on the O. K. Fraction. This compressor will also furnish air to the Rogers Syndicate lease, which belongs to the same company, but which is on Florence ground. A lease on the Jumbo has been given to W. H. Clark, W. V. Rice, and James Farrell. This lease is near the Atlanta line and so will be worked through the 360-ft. level of the Jumbo Ledge lease on the Atlanta. The Kinkead mill has been let to the people having the Garrett lease on the Kendall and ore from that property is being milled there.

Florence—The Little Florence, Florence Annex, Rogers Syndicate and Baby Florence are to resume soon. The shaft at the Polland lease is 500 ft. deep, but is to be sunk 50 ft. deeper. Crosscuts are to be driven south from the shaft on the 500 and 550-ft. levels. The Florence Leasing and Mining Company has been granted an extension of six months on its lease and has been given 70 ft. of additional ground. The shaft at the Baby Florence lease, which is now 285 ft. deep, is to be sunk another 100 ft.

Little Florence—This lease is preparing to resume and will start as soon as sufficient men can be obtained. This lease has only 68 more days to run. About 100 men will be required at this lease to warrant the company to resume; as the lease is in good ore, things must be rushed. The shaft is to be sunk another 100 feet.

ESMERALDA COUNTY—SILVER PEAK

Pittsburg-Silver Peak—At present the mill is treating ore from the mine dumps. The various dumps on the property, belonging to this company, are said to contain over 60,000 tons of ore and about half that tonnage lies broken in the stopes. Only 60 stamps are running as yet but the other 40 stamps will be in operation soon. The cyanide plant is not completed so the slime is being stored for future treatment. About 200 men are working at the mines and mill.

LINCOLN COUNTY—PIOCHE

The difference between the miners' union and mine owners regarding the wages has been settled for the present. The Nevada-Utah has increased its force at the Day mine. J. J. Gaskill, general manager, now has charge of the operations of the Nevada-Utah.

NYE COUNTY—BULLFROG

Montgomery-Shoshone—About 50 tons of ore are being shipped each day in addition to the concentrates. About 200 tons of ore per day are treated at the mill.

Homestake King—Two of the main retaining walls have been completed at the mill. A carload of machinery has been delivered at the mill site and much of the timber is already on the ground.

National Bank—R. W. Sparling is erecting the machinery to treat the ore from the dump. A lease on a block of ground 300 by 300 ft. has been let to E. W. Dreyer. This ground is on the north end of Ladd mountain; a vein has been discovered and the prospecting of this has begun.

Tramps Consolidated—The main vein has not been cut on the 600-ft. level of the Denver mine but a stringer of manganese-stained quartz, so characteristic of the district, has been found which carries some gold.

Montgomery Mountain Mining Company—Samuel Newhouse has been re-elected president; H. E. Peery, vice-president, and M. M. Johnson, a director instead of Mr. Parsons; 250,000 shares are to be given as bonus to the purchasers of the company's bonds.

Homestake—The car of machinery, which arrived some time ago, has been hauled to the mill site. About 25 men are working on the foundations.

NYE COUNTY—TONOPAH

The ore shipments from Tonopah mines for the week ending Jan. 30, as reported by the Western Ore Purchasing Company, consisted of 88 tons from the Tonopah Extension and 80 tons from the MacNamara. The Tonopah company sent 3100 tons, the Belmont company 940 tons, the Jim Butler 167 tons and the Montana-Tonopah 1100 tons to the mills, making the total shipments for the week 5475.

Belmont—Two veins to the south of the south vein are reported to have been found on the eighth level. These are said to be 8 in. and 15 in. wide and the ore of shipping grade. The south vein on the 800-ft. level is developed for a length of 300 ft. and is about 3 ft. wide. The Mizpah vein where cut on the 1000-ft. level is 6 ft. wide. Much development work is being done on the 1000-ft. level where the recent orebodies were found. During the week 30 to 40 stamps were kept running. The mill will treat some ore from the Jim Butler in the future. About 115 men are employed at the mine and mill.

Tonopah Extension—The usual amount of stoping and development is being done on all the levels above the 600-ft. level.

Montana Tonopah—The lowest work being done is in the winze from the fourth level. This is about 70 ft. deep. The usual tonnage of ore is being mined, most of it from the third level. Development work is being done on the second, third and fourth levels. Three shifts are working at the mill; 1044 tons were treated during the week ending Jan. 28. About 135 men are working at the mine and mill.

WHITE PINE COUNTY

Giroux Consolidated—The directors have been re-elected. No opposition developed at the meeting of the stockholders recently held in New York; over two-thirds of the shares were represented.

The company has voted to issue $1,000,000 in bonds, the treasury being low and more money being required

to complete the development of the properties. The cost of the further improvements required, including pumping station, pipe line, power transmission lines, etc., is estimated at about $500,000.

Nevada Consolidated—The capital stock of this company has been increased from $6,500,000 to $8,000,000. The increase is to provide for the issue of $3,000,000 in convertible bonds.

New Mexico

LEONARD WOOD COUNTY

Phelps-Dodge Company—This company has purchased the Perea land grant of G. W. Harrison, of Albuquerque, and will drill for oil. The first hole has been drilled about 200 ft.

SIERRA COUNTY

Virginian—This old mine, nine miles north of Kingston, on Perchie creek, has been leased by John H. Moffit and associates and operations have been begun. The leasers will have the use of the concentrating mill on the Keystone property, which was built two years ago and which was run only a short time. A tramway will be built from the adit to the mill and the low-grade ore will be dumped directly into the mill bins.

North Carolina

ROWAN COUNTY

Considerable activity is reported at Gold Hill. Work at the Proctor mine is being pushed with a force of 75 men. The old Gold Hill mine is also again in active operation, 80 men being employed.

Union Copper Company—It is reported that this company will unwater its mine at Gold Hill and resume operations. The ore is to be treated to recover the gold contents, and a new mill will be put in.

Ohio

FRANKLIN COUNTY

A tract of 127 acres of land underlaid with limestone of good quality has been sold, and a large quarry is to be opened. The Columbus Iron and Steel Company, Columbus, Ohio, is the purchaser, and will use the limestone as flux.

Pennsylvania

ANTHRACITE COAL

Lehigh Coal and Navigation Company—This company has let contracts for 50 barges, of 100 tons capacity each, and will shortly let contracts for 50 more. They are to be used to carry coal through the canal from Mauch Chunk to Philadelphia. The canal has been dredged out and widened in some places and arrangements are being made to install an electric towing system.

BITUMINOUS COAL

Lafayette Coal Mine—The district mine inspectors have served notice on James Henderson, superintendent of this mine in Menallen township, near Connellsville, owned by the Atlas Coal Company, that, unless existing causes of danger are removed immediately, an application for an injunction calling for a suspension of work in the mine would be made to the court of common pleas of Fayette county in accordance with the provisions of article 11, section 1, of the act of May 15, 1893. In the communication the inspectors state that they examined the mine Jan. 30, 1908, and were agreed in the opinion that there is immediate danger arising from the lack of proper ventilation, from the use of open lights and from deposits of coal dust, which jeopardize the lives and health of employees therein. The superintendent is instructed to remove such conditions forthwith and provide at least 125,000 cu. ft. of air per minute at the inlet and have air properly circulated through all working places; to install a sufficient water system and thoroughly wet the roof, sides and floor of the working places, entries and cross-entries and to thoroughly water a distance of 100 ft. back of the working places immediately before a shot is fired.

Pittsburg Coal Company—A number of miners, employed at 10 mines of this company, have struck on account of an order directing the use of a smokeless powder known as fulmenite in the mines, instead of the ordinary black powder. The strikers object to the use of this powder unless shot-firers are employed. The fulmenite is more expensive than black powder.

South Dakota

LAWRENCE COUNTY

Grainger—Eastern capital is negotiating for the purchase of these six claims in Carbonate camp. The property is owned by J. P. Hymer, of Denver, and shows free milling ore.

Homestake—Checks for dividend No. 401, the first since the fire of 1906, received here by local stockholders, have had an encouraging effect on general mining conditions. The company is now repairing all of its mills and tearing down some old wooden structures and supplying more sheet iron to insure against further fire in the plants.

Mogul—The mine is being wired to permit of the installation of the Temple air-electric drill, successfully tried by the Homestake.

Monarch—An old mill on the property is being renovated and will have a capacity of 30 tons daily. The ore is free-milling quartz of low grade, shipments of the higher grade ores having been stopped to permit of deeper development.

Oro Cache—A porphyry dike containing gold is being opened up preparatory to the probable erection of a mill this year.

Trinity—Dave Short and Dan Flickinger, the original locaters, have extensive development work planned for the spring on the Llewellyn claim from the bottom of the 150-ft. shaft, where high-grade ore was formerly mined.

Tennessee

SCOTT COUNTY

Baker Coal and Coke Company—This company has been organized at Rockwood to open up a tract of coal land near that place. Some work has already been done. The company has elected the following officers: J. N. Baker, president and general manager; Archie McDonald, vice-president; S. P. Sparks, secretary and treasurer, and V. D. Sparks, superintendent.

Utah

SALT LAKE COUNTY

Boston Consolidated Mill—Two sections are running and the third will be working on ore within the next week. Each section will handle about 250 tons per day; there are 12 sections in the entire plant.

Bingham Central-Standard—This company, operating in Bingham, has increased the force of men at the mine and is doing much development work. The new bond issue of $250,000, it is said, has been practically all subscribed.

Utah Copper Company—According to President McNeill, the Garfield mill, running at seven-twelfths capacity, in November treated 116,000 tons of ore, yielding 3,000,000 lb. of copper, at a cost of 7.95c. per lb. of refined metal at New York. It is said that all the outstanding bonds of this company have been converted into stock, wherefore the proposed issue of $1,500,000 will be a first lien on the company's property.

Yampa—This company is now treating ore from the Centennial-Eureka mine, along with its own sulphide ore, and is making a matte assaying 50 per cent. copper, which is being shipped to Chrome, N. J., for converting.

BEAVER COUNTY

Newhouse—According to Samuel Newhouse, this company is now producing 1,000,000 lb. of copper monthly at a cost of 6c. per lb., basis New York, including selling expenses. About one-half of the production is derived from direct-smelting ore and one-half from mill concentrates.

West Virginia

TAYLOR COUNTY

McGraw Coal Company—This company's mine at Simpson has been closed by a fire, the origin of which is unknown. Efforts are being made to extinguish the fire, but without success so far.

Canada

British Columbia

British Columbia—The copper production of this company in 1907 was 8,119,502 lb. Net earnings are said to have been about $700,000.

Nova Scotia

Colonial Copper Company—At a meeting of the stockholders in Baltimore last week, all the directors retired. A committee of three—A. Levering, J. S. Harmon and Dr. J. D. Blake—was appointed to prepare a plan for adjusting the company's affairs. This committee will report to an adjourned meeting, to be held March 4 next.

Mexico

Chihuahua

Greene Gold-Silver Company—This company is reported to be preparing to start up the El Salto cyanide mill at Ocampo in March. Surveys are being made for the installation of a hydro-electric plant of 600 h.p. to supply power for the mill and the mines. Hoisting machinery is to be installed for a 2000-ft. shaft on the Santa Juliana.

Palmilla—A. J. McQuatters and T. S. Shepperd have bought the G. C. Beckman interest in this mine. There will be no change in the management. The mine is completely unwatered and about a carload of ore is being shipped from new workings at the bottom of the main shaft. A 600-gal. Prescott pump is used to raise the water to the storage tanks. A pump station has been cut on the 600-ft. level and a 500-gal. electric pump is being installed. The San Juan shaft has been retimbered and enlarged to three compartments.

Moctezuma Lead Company—This company at Santa Barbara is shipping a carload of ore a day to the smelting works at San Luis Potosi from the Cabrestante and Central shafts.

Veta Colorado Mining and Smelting Company—The company's 80-stamp mill, in the Parral district, is being pushed to completion. It is expected that 20 stamps will be ready for operation by April 1.

Guanajuato

Cabrastante—This mine has been unwatered and a permanent pump installed to keep the water down. The Bolanitas mine is being cleared and supplied with new machinery. It is to have a new cyanide mill.

El Cubo—The company is extending its adit to meet the Villalpando shaft, a distance of 1300 ft. The company is also preparing to build a 60-ton mill.

Jalisco

Los Reyes Mining Company—This company, of Guadalajara, has finished unwatering the San Juan mine of Los Reyes group and has discovered rich ore in its lower workings. An electric pumping plant driven from the company's power plant on the Los Reyes river was installed some time ago. Electric drills will be used in some of the workings. The company is shipping high-grade ore and treating lower-grade material by amalgamation and lixiviation.

Mexico

El Oro—During December No. 1 and No. 2 mills both ran 30 days, and together crushed 21,644 tons of ore, producing $180,893; working expenses were $100,700; development, $14,967, or $5.34 per ton; net surplus, $65,226; profit from the railway for the month, $4,383, giving a total of $69,609. An average monthly profit of about $80,000 can be expected from the low-grade ores now being milled.

Esperanza—The mill ran 30 days in December and crushed 14,004 tons of dry ore; concentrates shipped to smelters amounted to 508 tons of dry ore; the estimated value of bullion produced, $138,379; estimated value of concentrates, $85,974—$224,353; receipts from rents and other sources were $109; total, $224,462; less working expenses, $122,281; giving a surplus of $97,128. This is at the rate of about 54 per cent. annually on the issued capital.

American Rincon Mining Company—This company is reported to be taking out $3000 in high-grade ore per week from its property near Temascaltepec in the western part of the State. A 20-stamp mill will be running in a few weeks.

Sinaloa

Butters—The mill of the Charles Butters syndicate at Copala, eight hours from Mazatlan, is in operation and giving satisfactory results. The process is direct cyaniding; all machinery is driven by electric power.

Sonora

Cieneguita Copper Company—The annual meeting of this company was held in New York on Feb. 3. The membership of the board of directors was increased to 11; the old board was re-elected and Frank Fitz, of Mexico, and Dr. Eugene Boyce, of Grand Rapids, Mich., were elected to two of the new places on the board. General manager Howbert reported that the grade of ore from the mines had improved between July and December from 19 oz. silver and 0.5 per cent. copper to 45 oz. silver and 2.5 per cent. copper. Development work during 1907 amounted to 3910 ft. The smelting plant is producing matte which assays from 40 to 60 per cent. copper. The report recommended the introduction of pyritic smelting.

Vera Cruz

Minatitlan Oil Refinery—The oil refinery built by S. Pearson & Son, Ltd., of London, is practically ready for operation. It has a capacity of 5000 bbl. per day. It is reported that the wells of the company yield sufficient crude oil to supply the plant as well as a small experimental refinery of 50-bbl. capacity. The company has 60,000 bbl, of oil in storage tanks and is preparing to ship both by rail and by steamer. Since the present requirement of the entire country is estimated to be from 800 to 1000 bbl. per day, there will be considerable production for export. The company is drilling in six different districts in Vera Cruz and at a number of place in Tabasco and Tamaulipas.

Africa

Transvaal

The production of gold in January is reported by cable at 560,329 oz. fine, or $11,582,000. This compares with 537,638 oz. in January, 1907, showing an increase this year of 22,691 oz., or 4.2 per cent.

Diamonds

Negotiations have lately been in progress between the De Beers and Premier companies looking toward a restoration of confidence in the diamond market. Profits of the Premier for 1907 are stated to be about £550,000. While it is deemed advisable to curtail output, it is not believed that it will be necessary to shut down all of the mines. With continued amicable relations between the two companies, together with the coöperation of the Transvaal government in permitting the Premier to retain the government's share of profits for the last financial year, aggregated £240,000, it is expected the company will be able effectively to carry on operations and avoid forcing diamonds on an unwilling market. As a result of the reaction in the diamond trade about 4500 diamond workers, or one-fourth of the total number in Amsterdam, are out of employment.

Europe

Belgium

The production of pig iron for the year is reported as follows, in metric tons:

	1906. Tons.	1906. Per Ct.	1907. Tons.	1907. Per Ct.
Forge Iron	226,900	15.9	226,430	15.9
Foundry Iron	101,430	7.1	100,020	7.1
Steelmaking Pig	1,103,130	77.0	1,101,490	77.0
Total	1,431,460	100.0	1,427,940	100.0

The changes were small. There were decreases of 470 tons in forge iron; 1410 tons in foundry; 1640 tons in steel-making pig; a total loss of 3520 tons, or 0.2 per cent.

South America

Peru

Cerro de Pasco—This company's production of copper in 1907 was 20,152,000 lb. The December output was 2,500,000 lb., and that rate is expected to be maintained during 1908. The smelting works are to be increased in capacity.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 12—The coal trade in the West is showing the effects of industrial depression more as time goes on. In Indiana and Illinois many mines are running on part time. The same is the case in a considerable part of the Pittsburg district and in Ohio. The demand for steam coal is much below what it was a year ago, and the railroad shipments are showing decreases almost everywhere.

In the East the bituminous coal trade is showing the same conditions. Most of the tidewater terminals are clogged with coal, and the railroads are refusing to take shipments until the present surplus is worked off. There is no lack of cars, but rather a surplus.

The anthracite trade keeps up fairly well, though there is some talk of curtailing production, and the companies have put most of their collieries on short time. The large January shipments caused some surprise.

The probabilities of a joint meeting to fix mining wages are still the subject of general discussion in the trade.

Coal Traffic Notes

Tonnage originating on Pennsylvania Railroad lines east of Pittsburg and Erie, year to Feb. 1, in short tons:

	1907.	1908.	Changes.
Anthracite.....	488,935	465,252	D. 23,683
Bituminous.....	3,502,681	2,781,830	D. 720,851
Coke.....	1,229,734	597,841	D. 631,893
Total.....	5,221,350	3,844,923	D. 1,376,42

Average daily tonnage for the period, 158,223 tons in 1907, and 120,154 tons this year.

Anthracite coal shipments in January were 5,249,946 long tons in 1907, and 5,618,339 tons in 1908; an increase of 368,393 tons, or 7 per cent., this year.

Shipments of Broad Top coal over the Huntingdon & Broad Top Railroad for the year to Feb. 1 were 59,835 tons.

New York

Feb. 11—The hard-coal market still continues dull, although the cold weather of the past few days has tended to strengthen it locally. Last week the producing companies operated their mines only four days, and this, together with slow transportation would naturally tend to cause a shortage; but this does not seem to have been the case. Dealers are still selling all sizes below the circular prices which are quoted as follows: Broken, $4.75; egg, stove and chestnut, $5; pea, $3.25@3.50; buckwheat No. 1, $2.75@3; buckwheat No. 2 or rice, $2.15@2.25; barley, $1.75; all f.o.b. New York harbor.

Bituminous

There seems to be a slight improvement in the soft-coal market, and stocks are being used up slowly but surely. The better grades are beginning to feel a moderate demand, but the trade does not expect much business until new contracts are made. There have been a number of inquiries as to contract prices, but since the railroad rates have not been announced, it is not believed that contracts will be closed until the middle of March.

Last fall there were frequent allusions to higher rates of pay at the mines, and talk of strikes was occasionally heard. When the financial depression set in, the miners abandoned all thought of agitation, and now the operators are considering the question of reducing the scale of wages; but nothing has so far been done.

In New York harbor the demand is slight and the market is very dull. Good grades of steam coal bring $2.45@2.65. Coal at the shipping ports is being worked off and now only coal for which there are existing orders is being shipped. Unloading from cars is difficult owing to the badly frozen condition of the coal.

Trade in the far East is so dull and of such a small volume that nothing can be said of the market in this territory. Along the Sound trade is picking up slightly and the better grades are feeling some improvement. Transportation from mines to tide is slow, coal taking from 10 days to two weeks to run through. This is due largely to the removal of many locomotives from the regular traffic. Coastwise freight rates to Boston and equivalent points are quoted nominally at 70@75c. per ton.

Birmingham

Feb. 10—Light railroad business has affected the coal market some in Alabama. While there is still a healthy production of coal noted, the output is much lighter than it should be. Coal prices have been reduced some. The first month of the year shows a decided difference as compared to the production for the same period last year. The only feature of the past two weeks in the coal market in this State has been the resumption of one of the Tennessee company's largest coal washers in the Pratt Mines division.

Indianapolis

Feb. 10—Shipping rates on coal used by railroads in Indiana will not be changed by the Indiana Railroad Commission. The decision follows a complaint that there was a discrimination in coal rates in favor of railroads and against the consumers of commercial coal. Testimony given before the commission was to the effect that the coal-carrying roads of Indiana had had great difficulty in getting the contracts to furnish Indiana coal to connecting lines within the State. It was shown that it was only after inducements in the way of rates that coal-carrying roads had obtained contracts to furnish railroads crossing Indiana, and that previous to such contracts these roads brought coal into the State for their use from the mines of Ohio and Pennsylvania and that if rates were increased they would do so again. The commission figured that an increase in existing rates, though apparently discriminating, would destroy the market for a million tons of Indiana coal annually. The commission further reasoned that the mining of this coal, the hauling of the same to the various coal-consuming railroads, involves the employment of several thousand men, affects the welfare of a large number of Indiana citizens, and pays to the miners, railroad employees and other laborers of the State at least $1,500,000 annually. The commission holds that it is neither required nor justified by law or public policy to hold that the rates complained of are unjustly discriminative and in the interest of Indiana coal declined to disturb the present rates charged for delivering coal to connecting railroads.

Pittsburg

Feb. 10—The demand for coal has increased somewhat, and prices are a trifle higher. Mine-run coal is quoted at $1.20@1.30 f.o.b. mine, but on contract 5c. less can be done. Slack is strong at 80@90c. Production is greater than last week and the railroad mines are operating to from 50 to 60 per cent. of capacity. The river mines are running full, and preparations are being made to send out large tows to the Southern markets, as the rivers will be navigable again this week.

Connellsville Coke—Coke prices continue weak and for spot delivery furnace coke is quoted at $1.65 and on contract $1.85@1.90 is named. For both spot and on contract foundry coke has declined to

$2.35. These prices are f.o.b. oven. The H. C. Frick Coke Company is operating more than one-half of its ovens, but the coke is not going to the general trade and has no influence on the market. The *Courier* in its summary for the week gives the production in both regions at 215,560 tons, and the shipments aggregated 5618 cars, distributed as follows: To Pittsburg, 2306 cars; to points west of Connellsville, 4913 cars; to points east of Connellsville, 399 cars.

Foreign Coal Trade

Fuel imports and exports in Belgium, 10 months ended Oct. 31, metric tons:

Imports:	1906.	1907.	Changes.
Coal	4,426,454	4,400,677	D. 25,777
Coke	293,317	300,893	I. 7,576
Briquets	110,191	123,372	I. 13,181
Total	4,829,962	4,824,942	D. 5,020
Exports:			
Coal	4,210,105	3,942,510	D. 267,595
Coke	713,139	714,847	I. 1,708
Briquets	386,575	355,104	D. 31,471
Total	5,309,819	5,012,461	D. 297,358

Excess of total exports, 1906, was 479,857 tons; in 1907 it was 187,519 tons.

Imports of coal into Spain, 10 months ended Oct. 31, 1907, were 1,580,859 tons, a decrease of 278,745 tons. Imports of coke, 210,951 tons, an increase of 34,764 tons.

The coal production in Germany for the full year is reported as follows, in metric tons:

	1906.	1907.	Changes.
Coal	137,117,926	143,222,886	I. 6,104,960
Brown coal	56,415,333	62,319,802	I. 5,904,469
Total mined	193,533,259	205,542,688	I. 12,009,429
Coke made	20,260,572	21,938,038	I. 1,677,466
Briquets made	14,500,851	16,414,478	I. 1,913,627

About 70 per cent. of the briquets are made from brown coal, or lignite.

The coal production of the Nord and the Pas-de-Calais, the two principal districts in France, for the full year was as follows:

	1906.	1907.	Changes.
Nord	6,209,852	6,900,657	I. 690,805
Pas-de-Calais	15,786,730	17,804,836	I. 2,018,106
Total coal	21,996,582	24,705,493	I. 2,708,911
Coke made	1,678,418	1,945,882	I. 267,464
Briquets made	958,009	1,191,294	I. 233,285

The production in 1907 was the greatest ever reported.

Iron Trade Review

New York, Feb. 12—There seems to be a tendency toward revival in some branches of the trade, but others are still extremely dull. In pig iron business is mainly of the retail sort, and users will not order far ahead. The only demand for finished steel is for structural material, and orders for some buildings and some bridge work are pending. Others would come in if concessions could be secured. Mills seem to have a little more work, and the idle capacity is gradually, but slowly, decreasing.

At meetings of the Eastern and Western Bar Iron associations, it was decided to stop the cutting on bars which has been going on. The price is to be held at 1.50c. Pittsburg, equivalent to 1.66c. tidewater; and at 1.50c. for Pittsburg deliveries and 1.47c., Pittsburg, for Chicago and points west.

The Pennsylvania Railroad Company has ordered 55,000 tons of steel rails, divided among the Steel Corporation, the Cambria, Pennsylvania and Lackawanna companies. The rails are to be made under new specifications prepared by the company. In connection with this order, the company has issued a statement, which will be found on another page.

Pig-iron Production — The monthly statements of the furnaces show that on Feb. 1 there were 142 coke and anthracite stacks in blast, having a total weekly capacity of 242,000 tons of pig iron. This is an increase of 6900 tons over Jan. 1, but a reduction of 269,400 tons as compared with Oct. 1 last, and of 286,200 tons as compared with the maximum reached on July 1, 1907. Taking the estimate of the *Iron Age*, with an allowance for the charcoal furnaces, the total production of pig iron in January was approximately 1,070,500 tons.

Scotch Pig Iron—The Scottish Ironmasters' Association makes the following report for the full year:

	1906.	1907.	Changes.
Stocks, Jan. 1	91,935	90,548	D. 1,387
Production	1,451,068	1,403,447	D. 47,621
Total supply	1,543,003	1,493,995	D. 49,008
Consumption	1,081,364	997,692	D. 83,672
Exports	371,091	400,260	I. 29,169
Total	1,452,455	1,397,952	D. 54,503
Stocks, Dec. 31	90,548	96,043	I. 5,495

Exports in 1907 included 59,199 tons to the United States. The average number of furnaces in blast in 1907 was 90.44; the average make of pig iron per furnace per week was 293 tons.

Baltimore

Feb. 11—Included in exports for the week were 1226 tons of steel billets. In the imports were 3570 tons of cupreous pyrites from Spain. Receipts of iron ore were 11,300 tons from Cuba.

Birmingham

Feb. 10—While there were no large sales of pig iron made here during the past week, the aggregate business was quite satisfactory. The furnaces will continue to hold iron at $13.50 per ton, No. 2 foundry, until such time as the demand warrants a better price. The shipments are not very active yet, though equal to the production. There has been a change of mind as to increasing the make, though two furnaces at least are ready for the application of the torch.

The Bessemer rolling mills of the Tennessee Coal, Iron and Railroad Company are in operation. There will be some improvements made in the rail mill at Ensley, the work to require several weeks' time at least. The Birmingham rolling mills are practically doing nothing, while the Gate City mills of the Republic company are cold.

Union molders, patternmakers and machinists in the Birmingham district have entered a protest against a readjustment of wages and have referred the matter to their international organizations.

Many rumors prevail in reference to intentions of the United States Steel Corporation in this district, though there is nothing definite to be stated.

Pittsburg

Feb. 11—There seems to be a better tone in the iron and steel markets and indications point to an improvement, compared with the dull conditions that have prevailed lately. It is figured that the steel mills are being operated to nearly one-half capacity on an average. Some of the large plants are running practically full, while others are doing considerably less than one-half of their normal production. The placing of 55,000 tons of rails by the Pennsylvania Railroad Company has greatly stimulated the market. A Western road is inquiring for about 60,000 tons and it is believed the contract will be closed in a few days. This order will go to the Illinois Steel Company. The Pennsylvania order is allotted as follows: United States Steel Corporation, 27,500 tons; Pennsylvania Steel Company, 11,000 tons; Cambria Steel Company, 11,000 tons; Lackawanna Steel Company, 5500 tons.

Outside of a few independent producers the prices decided upon at the recent meeting in New York are being maintained. In order to protect the price of steel bars at 1.60c., iron-bar makers were asked to readjust prices and it was arranged to make an advance of $2 a ton. This puts the price of iron bars at 1.50c. Pittsburg. Recently the price of 1.40c. was shaded for both Pittsburg and western delivery, but now it would be difficult to buy at less than the price established. The low price of scrap was responsible for the cutting in iron bar prices and it is reported, but not confirmed, that the Steel Corporation in order to stimulate scrap prices has entered the market for an unusually large tonnage. One rumor says it will buy 100,000 tons. As a result of this report scrap prices have advanced and are likely to go much higher.

Pig Iron—Interest is centered in meeting of ore producers and foundry-furnace interests held in Cleveland on Friday and Saturday. The object of these meetings was to stop price reductions and some success has attended the efforts. Ore prices will remain unchanged, but this is not regarded as important, since there is enough of last season's ore to

keep the furnaces that are operating well supplied until July and probably longer. It is estimated that less than one-half of the tonnage brought down last season will be mined this year. The producers of foundry pig iron are endeavoring to hold the product on a basis of $17, Valley furnaces, for No. 2 and maintain a differential of at least $3 a ton between Northern and Southern foundry iron. Most of the large furnace interests were represented at the meeting and will try to keep the prices at the figures agreed upon. There are, however, some independent furnaces that are still selling at low rates. One sale of No. 2 foundry was recently recorded at $15.50, but it is understood that $16 can easily be done. Bessemer pig is still being quoted by the large concerns at $18, but the only transactions noted are at $1 a ton less. Basic is $15.75@16 and gray forge from $15@15.50, Valley furnaces.

Steel—The report that billets are being shaded lacks confirmation and both bessemer and open-hearth billets continue to be quoted at $28 and sheet-bars at $29. Plate prices are not strong but are still quoted at 1.70c. Steel bars also are weak, but the large producers will not name less than 1.60c.

Sheets—Some additional sheet mills have been started by the leading producers and some improvement in the market is noted. Prices are firm, black sheets being quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferromanganese—The market remains unchanged at $48 per ton.

Dusseldorf, Germany

The German Iron and Steel Union reports the production of pig iron in December at 1,106,375 metric tons, or 5850 tons less than in November. For the year ended Dec. 31 the production was, in metric tons:

	1906 Tons.	1906 PerCt.	1907 Tons.	1907 PerCt.
Foundry iron	2,103,684	16.9	2,259,416	17.3
Forge iron	854,536	6.9	786,113	6.4
Steel pig	943,573	7.6	1,034,650	8.0
Bessemer pig	482,740	3.7	471,355	3.6
Basic pig	8,088,534	64.9	8,494,226	65.1
Total	12,473,067	100.0	13,045,760	100.0

This shows increases of 155,732 tons in foundry iron; 91,077 tons in steel pig, which includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys; 405,692 tons in Thomas, or basic pig. There were decreases of 68,423 tons in forge iron, and 11,385 in bessemer pig. The total gain was 572,693 tons, or 4.6 per cent.

The German Stahlwerks-Verbande, the combination, or selling trust, of the German steel works, reports business for the year as follows, in metric tons:

	1906.	1907.	Changes.
Half-finished forms	1,861,923	1,557,823	D. 304,100
Railroad material	1,936,800	2,327,362	I. 390,562
Rolled iron & steel	1,940,179	1,698,875	D. 241,304
Finished products	5,738,902	5,584,110	D. 154,792
Total	11,477,804	11,168,170	D. 309,634

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Feb. 12.
At all United States Ports in Dec. and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1907	$ 1,004,441	$44,448,509	Imp. $43,444,068
" 1906	1,880,895	7,617,237	" 5,736,342
Year 1907	55,215,681	143,398,066	" 88,182,385
" 1906	46,709,158	155,579,380	" 108,870,222
Silver:			
Dec. 1907	4,407,485	4,315,452	Exp. $92,033
" 1906	7,404,905	3,999,269	" 3,405,636
Year 1907	61,619,653	46,005,776	" 15,613,877
" 1906	60,957,091	44,227,841	" 16,729,250

Imports at the port of New York for the week ended Feb. 8: Gold, $352,273, chiefly from Cuba; silver, $23,156. Exports, gold, $527,475, chiefly to Argentina; silver, $797,118, nearly all to London.

Specie holdings of the leading banks of the world, Feb. 8, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$254,081,300
England	$187,787,955	.....	187,424,500
France	544,221,460	$181,203,040	719,078,800
Germany	156,595,000	64,900,000	221,495,000
Spain	78,435,000	138,825,000	217,260,000
Netherlands	38,390,000	21,666,500	60,056,500
Belgium	18,856,665	9,428,335	28,285,000
Italy	182,805,000	23,000,000	205,805,000
Russia	579,345,000	29,065,000	608,410,000
Aust.-Hungary	231,295,000	61,580,000	292,875,000
Sweden	19,535,000	.....	19,535,000
Norway	7,710,000	.....	7,710,000
Switzerland	16,210,000	.....	16,210,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Silver Market

SILVER AND STERLING EXCHANGE.

Feb.	Sterling Exchange.	Silver, New York, Cents.	Silver, London, Pence.	Feb.	Sterling Exchange.	Silver, New York, Cents.	Silver, London, Pence.
6	4.8650	55⅜	25 9/16	10	4.8625	57⅝	26⅝
7	4.8650	55⅞	25 13/16	11	4.8630	56¾	26 3/16
8	4.8640	56½	26⅛	12	.....	....	26 7/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

The absorption and distribution of the large amount of silver held in London, followed by good India and China buying, has made a firm market and silver had a sharp advance to 26⅝d. in London.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Jan. 30:

	1907.	1908.	Changes.
India	£ 496,510	£ 398,900	D. £ 97,610
China	.....	281,400	I. 281,400
Straits	76,300	.....	D. 76,300
Total	£ 572,810	£ 680,300	I. £ 107,490

Receipts for the week were £4000 from the West Indies and £286,000 from New York; total, £290,000. Exports were £100,000 to India and £190,400 to China; £290,400 in all.

Indian exchange has been slightly easier, but the Council bills offered in London were taken at an average of 15.91d. per rupee.

Mint purchases of silver: Feb. 5, 150,000 oz. at 55.632c., delivery Philadelphia; Feb. 7, 150,000 oz. at 56.317c., deliveries 100,000 oz. at Denver and 50,000 oz. at San Francisco; Feb. 9, 100,000 oz. at 58.067c., New Orleans.

Other Metals

Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
6	13½ @13¾	13⅝ @13⅝	61½	28½	3.70 @3.75	4.70 @4.75	4.55 @4.60
7	13¼ @13¾	13¼ @13½	61⅛	29	3.70 @3.75	4.72½ @4.77½	4.57½ @4.62½
8	13½ @13⅝	13¼ @13½	.....	29½	3.70 @3.75	4.75 @4.80	4.60 @4.65
10	13¼ @13½	13⅜ @13⅝	59⅜	29	3.70 @3.75	4.77½ @4.82½	4.62½ @4.67½
11	13¼ @13½	13⅜ @13¼	59½	29	3.70 @3.75	4.80 @4.85	4.65 @4.70
12	.....	.....	.....	.....	.....	.....	.....

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—There has been some small buying by domestic consumers, but the continued absence of any large demand from them, and the recent development of a satiated condition of the European market make it difficult to find an outlet for such quantities of copper as are offered for sale from day to day. There is keen competition for what small orders present themselves, and though liberal concessions on last prices are being made, the volume of business fails to increase. The market closes weak at 13¼@13½ for Lake copper, and 13⅛@13¼c. for electrolytic in ingots, cakes and wirebars. Casting copper has been especially pressed for sale, with 13@13⅛c. as the average for the week.

Under exceptionally heavy selling orders, which are said to emanate from this side, the standard market in London has been steadily declining and closes almost at the bottom, £59 10s. for spot, £59 17s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £57; best selected, £64@65; strong sheets, £67@68.

Exports from New York and Philadelphia for the week were 1825 tons. Exports from Baltimore are given by our special correspondent at 90 long tons.

Copper Sheets and Wire—The base price for sheets is 20c.; wire, 16¼@16½c. per pound.

Tin—The advance in the London market, which toward the end of last week

made further progress, was checked the beginning of this week owing to the failure of a large shipbuilding firm in England, which had a weakening effect on all the metal markets. While quotations at the end of last week reached £130 10s. for spot, £131 for three months, the market this week closes easier at £129 5s. for spot, £129 10s. for three months.

Spot tin in this market is becoming extremely scarce, and in sympathy with the advance in the London market of last week, as much as 29½c. was paid here for spot metal. The decline abroad was followed in this market, which closes at 29c. per pound.

Lead—Business is light and the market is quoted unchanged at 3.70@3.75c., New York.

Little interest is being shown in lead in the London market, where the close is neglected at £14 7s. 6d. for Spanish lead, £14 10s. for English lead.

Spelter—The starting up of a number of plants requiring spelter for galvanizing purposes has stimulated business, and as there is little pressure to place the metal at ruling prices, the market has advanced further and closes firm at 4.80@4.85c. New York, 4.65@4.70c. St. Louis.

The London market has also improved and closes firm at £20 17s. 6d. for specials.

Zinc Sheets—The base price is $7 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru. The freight rate to New York is 27.50c. per 100 lb.

Antimony—The market is weaker and an unsettled feeling prevails, both here and abroad. A small amount of spot business for immediate needs is being done. Quotations are 9¼@9½c. for Cookson's; 9@9¼c. for Hallett's; and 8⅛@8¾c. for ordinary brands.

Platinum—The market shows little life and only a small volume of business. Quotations remain unchanged at $28 for hard platinum, $25.50 for ordinary, and $17 for scrap. Prices are per troy ounce.

Nickel—For large lots, New York, the chief producer quotes 45@50c. per lb. according to size and terms of order. For small quantities, 50@65c., same delivery.

Aluminum—The current price for No. 1 ingots, in ton lots, is 33c. per lb. For rods and wire, No. 0000 to 10, base price is 38c. For sheets, No 13 to 24, B. & S. gage, base price is 40c. Tubes, 1¼ to 3½ in., base 50c. Higher prices are charged for small lots.

Cadmium—The price is $1.25 f.o.b. Cleveland in 100-lb. lots. A higher price is asked for smaller lots.

Quicksilver—New York quotations are $45 per flask for lots of 100 flasks or over, and $46 for smaller orders. San Francisco quotations are $44.50@45.50 for domestic orders; for export nominal, at about $1.50 lower. The London price is £8 5s. per flask, with £8 3s. 9d. quoted from second hands.

Wisconsin Ore Market

Platteville, Wis., Feb. 8—The price paid for zinc ore was lowered again this week to a base price of $37@38 per ton of 60 per cent. ore. A price of $22 per thousand is offered for 80 per cent. lead ore, but no new sales are reported.

Shipments for the week ended Feb. 8 were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	375,900	.....	.....
Hazel Green	150,000	.....	.....
Platteville	144,990	.....	.....
Benton	118,260	.....	.....
Livingston	80,000	.....	.....
Galena	78,000	.....	.....
Harker	66,000	.....	.....
Cuba City	65,000	.....	.....
Linden	43,030	.....	.....
Dodgeville	.....	60,000	.....
Total	1,121,180	60,000	.....
Year to Feb. 8	6,276,140	60,000	.....

Other camps made no shipments.

Missouri Ore Market

Joplin, Mo., Feb. 8—The highest price paid for zinc ore was $40 per ton, on a base price of $36 to $38 per ton of 60 per cent. zinc, and the average for all grades was $35.50. The highest price for lead ore was $51.50 per ton delivered f.o.b., and the average price for all grades was $49.96 per ton.

Following are the shipment of zinc and lead from the various camps of the district for the week ending Feb. 8.

	Zinc, lb.	Lead, lb.	Value.
Joplin	2,246,270	383,390	$52,264
Webb City-Carterville	1,470,370	703,490	45,523
Galena	541,250	131,290	13,064
Duenweg	512,360	86,110	11,374
Badger	369,990	98,090	9,667
Granby	600,000	20,000	6,700
Alba-Neck	251,470	21,010	5,554
Aurora	320,510	11,680	5,225
Spurgeon	265,560	21,940	3,784
Carthage	164,790	.....	3,295
Prosperity	53,830	87,600	3,212
Zincite	87,310	.....	1,615
Stott City	53,590	.....	966
Totals	6,937,300	1,564,600	$162,243
6 weeks	42,416,600	6,268,670	$ 904,595
Zinc value, the week, $123,173; 6 weeks, $			755,174
Lead value, the week, 39,070; 6 weeks,			149,421

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	.....	February	84.58	.....
March	48.66	.....	March	82.75	.....
April	48.24	.....	April	79.76	.....
May	45.98	.....	May	79.56	.....
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

The producers of zinc have realized that the recent upward flurry in zinc ore prices did not warrant the enormous increase in the output that followed, and a number of the mines that cannot produce ore on the present level of prices are arranging to close down their mines again. The output of the past week was large, and as the shipment was light the stock in the bins has been excessively increased.

Chemicals

New York, Feb. 11—The general market is quiet and the volume of business is very small. Purchases are principally for spot delivery and few contracts are being signed. Producers are curtailing their production to meet the decreased demand hence supplies of heavy chemicals are not increasing to any extent.

Copper Sulphate—Business has been light but slightly improved. The attitude of the consumer is to purchase only for immediate demands. Quotations remain unchanged at $5.50 per 100 lb. for carloads and $5.75 for smaller lots.

Nitrate of Soda—Messrs. Mortimer and Wisner, New York, report the position of nitrate in the United States on Feb. 1 as follows, in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1	13,050	5,900	D. 7,150
Imports, Jan.	21,960	25,800	I. 3,840
Total Supplies	35,010	31,700	D. 3,310
Deliveries, Jan.	30,231	28,945	D. 1,286
Stocks, Feb. 1	4,779	2,755	D. 2,024
Afloat for U. S.	72,500	70,000	D. 2,500

Quantities afloat include all cargoes reported and due to arrive by May 15 next.

Mining Stocks

New York, Feb. 12—The general stock markets have continued irregular and confused. Yesterday the conditions culminated in sharp breaks in the quotations of many stocks. At the close there was a rally, but it was not strong enough to compensate for the previous losses. The trading during the week was mainly professional, and the outside public has done very little buying.

The curb mainly followed the lead of the Stock Exchange. Trading was not heavy, and prices were weak. Losses were not large, however. The heavier business was in the Nevada stocks, only a few coppers attracting attention.

Boston

Feb. 10—Again there is nothing to report but a market of declining prices in mining shares. There is an utter lack of support on the part of the public, while room traders have been taking advantage of this fact by playing the short side. Offerings of stocks have also been a factor.

Calumet & Hecla is off $30 to $635 on comparatively light trading. This company is again soliciting proxies for the annual meeting of the Osceola Consolidated, to be held March 12, being the largest stockholder. Calumet & Arizona is

off to $5.75 to 106, Copper Range $5 to $58.25.

Amalgamated has followed New York in its price movements, and is $4.50 lower at $46.75. Arizona Commercial is off $3.87½ to $16.

Superior Copper has been taken from the curb and placed on the regular Stock Exchange list, and Utah Copper is soon expected to be listed. Shares of the Washington Copper Company have been stricken from the list. Deposits of Balaklala for exchange into First National Copper, 50c. paid, are coming in well, although the time for deposit has been extended.

Curb prices have followed the trend of the general market.

STOCK QUOTATIONS

NEW YORK	Feb. 10
Name of Comp.	Clg.
Alaska Mine	⅜
Am. Nev. M. & P. Co.	....
Amalgamated	47⅞
Anaconda	29⅞
Balaklala	2¾
British Col. Cop.	4½
Buffalo Cobalt	2¼
Butte & London	.96
Butte Coalition	17½
Butte Cop. & Zinc.	....
Cobalt Contact	....
Colonial Silver	⅞
Cum. Ely Mining.	7
Davis Daly.	4
Dominion Cop.	2
Douglas Copper	4½
El Rayo	1⅝
Foster Cobalt	.65
Furnace Creek	.25
Giroux Mine	3⅛
Gold Hill	¾
Granby, New	....
Greene Gold	1
Greene G. & S	⅝
Greenw'r & D. Val.	.75
Guanajuato	2½
Guggen. Exp.	150
Hanapah	20
McKinley Dar.	¾
Micmac	3⅝
Mines Co. of Am.	1½
Mitchell Mining	¾
Mont. Sho. C. (New)	3
Nev. Utah M. & S	3⅞
Newhouse M. & S.	7¾
Nipissing Mines	6¼
Old Hundred	1
Silver Queen	.90
Stewart	1
Tennessee Cop'r	26⅞
Union Copper New	1½
Utah Apex	4½
West Columbus	....
N. Y. INDUSTRIAL	
Am. Agri. Chem.	16½
Am. Smelt. & Ref.	60⅞
Am. Sm. & Ref., pf.	88½
Bethlehem Steel	....
Colo. Fuel & Iron	17
Federal M. & S., pf.	59
Inter. Salt	15
National Lead	36¼
National Lead, pf.	90
Pittsburg Coal	9⅛
Republic I. & S.	15
Republic I. & S., pf.	67
Sloss-Sheffield	37
Standard Oil	499
Tenn. C. & I	....
U. S. Red. & Ref.	....
U. S. Steel	26⅞
U. S. Steel, pf	89⅝
Va. Car. Chem	....
Va. I. Coal & Coke	....

ST. LOUIS	Feb. 8	
N. of Com.	High.	Low.
Adams	.25	.20
Am. Nettie	.04	.03
Center Cr'k	2.00	1.50
Cent. C. & C.	65.00	64.00
C.C. & C. pd.	76.00	73.00
Cent. Oil	95.00	90.00
Columbia	5.00	4.00
Con. Coal	18.00	15.00
Doe Run	130.00	120.00
Gra. Bimet.	.25	.20
St. Joe.	15.00	12.00

BOSTON	Feb. 10
Name of Comp.	Clg.
Adventure	2
Allouez	27½
Am. Zinc	....
Arcadian	4
Atlantic	10½
Bingham	5
Boston Con	14½
Calumet & Ariz.	107
Calumet & Hecla.	635
Centennial	21
Con. Mercur	....
Copper Range	58¾
Daly-West	8¾
Franklin	8½
Greene-Can	7⅝
Isle Royal	21
La Salle	12¾
Mass	3¾
Michigan	10
Mohawk	48½
Mont. C. & C. (new)	1
Nevada	9½
North Butte	44¾
Old Colony	.55
Old Dominion	34
Osceola	80
Parrot	13
Phoenix	....
Quincy	85
Rhode Island	3½
Santa Fe	....
Shannon	10½
Tamarack	61
Trinity	13¼
United Cop., com.	6¼
U. S. Oil	10
U. S. Smg. & Ref.	32½
U. S. Sm. & Re., pd.	37½
Utah Copper	....
Victoria	4⅝
Washington	....
Winona	6
Wolverine	....
Wyandotte	.90

*Ex. Div. †Ex. Rights.

BOSTON CURB	
Ahmeek	....
Ariz. Com	....
Black Mt.	4¼
East Butte	5
Hancock Con	....
Keweenaw	5
Majestic	1⅝
Raven	1 3/16
Shawmut	.44
Superior	....
Superior & Pitts	12¼
Troy Man	.85

LONDON	Jan. 29		
Name of Com.	Clg.		
Dolores	£1	8s	9d
Stratton's Ind.	0	3	3
Camp Bird	0	15	9
Esperanza	1	2	6
Tomboy	1	7	6
El Oro	1	0	7½
Oroville	0	12	6
Somera	...		.
Utah Apex	...		.
Ariz. Cop., pfd.	...		.
Ariz. Cop., def.	...		.

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS. Feb. 11.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
TONOPAH STOCKS		Golden Sceptre	...
Belmont	1.37	Homestake King.	.55
Extension	1.50	Montgomery Mt.	.14
Golden Anchor	.06½	Mont. Shoshone C.	3.00
Jim Butler	.45	Original Bullfrog.	.06
MacNamara	.37	Tramp Cons.	.29
Midway	.74	MANHAT'N STOCKS	
Montana	1.85	Manhattan Cons.	.24
North Star	.16	Manhat'n Dexter.	.11
Tonopah & Cal.	...	Jumping Jack	.08
Tono'h Mine of N.	5.37½	Stray Dog	.10
West End Con	.36	Indian Camp	.05
GOLDFI'D STOCKS		GREENW'R STOCKS	
Adams	.07	Furnace Creek	...
Atlanta	.37	Greenwater & D.V.	...
Blue Bell	.10	Green'rCop. M. & S.	...
Blue Bull	.19	United Greenwa'r	...
Booth	.27	MISCELLANEOUS	
Columbia Mt	.24	Golden Boulder	.10
Comb. Frac	.70	Hayseed	.30
Cracker Jack	.11	Lee Gold Grotto	.10
Dia'dfield B. B. C.	.22	Nevada Hills	3.12½
Goldfield Belmont	.15	Nevada Smelting.	1.20
Goldfield Con	4.93¾	Pittsburgh S. Pk.	1.30
Goldfield Daisy	1.00	Round Mt. Sphinx	.29
Goldfield Mining.	...		
Great Bend	.38		
Jumbo Extension	.51		
Jumbo Mining	...		
Katherine	.06		
Kendall	.18		
Laguna	...		
Lone Star	.12		
Lou Dillon.	...		
May Queen	.09		
Mohawk	...		
Oro	.16		
Red Hill	.34		
Red Top	...		
Roanoke	.07		
Sandstorm	.33		
Silver Pick	.34		
St. Ives	.48		
Triangle	.10		
BULLFROG STOCKS			
Amethyst	...		
Bullfrog Daisy	...		
Bullfrog Mining.	.10		
Bullfrog Nat. B.	.11		
Gibraltar	.15		
Gold Bar	.37		

COLO. SPRINGS	Feb. 8	Name of Comp.	Clg.
Acacia	6⅞	Black Bell	3
C. C. Con	4⅝	Dante	8¼
Doctor Jack Pot	7	Elkton	56
El Paso	30	Findlay	35
Gold Dollar	6½	Gold Sovereign	4
Isabella	34	Index	....
Jennie Sample	....	Jerry Johnson	8
Mary McKinney	32	Pharmacist	4
Portland	1.03	Un. Gold Mines	6½
Vindicator	80	Work	17

New Dividends

Company.	Payable.	Rate.	Amt.
Alaska Mexican	Jan. 28	$0.50	$90,000
Alaska Treadwell	Jan. 28	0.75	150,000
Alaska United	Jan. 28	0.15	27,030
Amalgamated	Feb. 24	0.50	765,440
Am. Cement	Jan. 23	0.30	60,000
American Coal	Mar. 2	1.25	62,500
Cambria Steel	Feb. 15	0.75	450,000
Camp Bird, Ltd.	Feb. 3	0.24	246,800
Consolidation Coal	Jan. 31	3.50	358,750
Doe Run	Feb. 15	0.50	29,531
Dolores, Ltd.	Feb. 27	0.15	59,400
El Oro	Jan. 15	0.36	388,800
Fairmont Coal	Jan. 31	2.00	240,000
Georges Creek C. & I.	Jan. 22	2.50	55,000
Hinds Consolidated	Feb. 27	0.02	100,000
Homestake	Jan. 25	0.50	109,200
Jamison	Jan. 18	0.02	7,800
Jeff. & Cl'f. C. & I., pfd.	Feb. 15	2.50	37,500
Jerry Johnson	Jan. 15	0.01	25,000
Montezuma M. & S.	Jan. 10	0.04	40,000
N. Y. Hond. Rosario	Jan. 25	0.10	15,000
Portland	Jan. 15	0.04	120,000
Providence S. J.	Feb. 1	5.00	30,000
Tenn. Copper Co.	Feb. 15	1.25	218,750
Vindicator Con.	Jan. 25	0.04	60,000

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Bell, Cal.	Feb. 15	Apr. 15	$0.01
Butler-Liberal, Utah.	Feb. 15	Mar. 6	0.01
East Tintic, Utah	Jan. 14	Feb. 9	0.01
Enterprise, Nev.	Jan. 9	Feb. 17	0.05
Imlay, Nev.	Jan. 24	Feb. 10	0.01
Ingot, Utah.	Feb. 17	Mar. 7	0.01
Lucky Dutchman, Nev.	Jan. 16	Feb. 8	0.01
Moduff, Utah.	Jan. 3	Feb. 4	0.01
Nevada Superior, Nev.	Jan. 24	Feb. 21	0.05
New Stockton, Utah.	Feb. 26	Mar. 18	0.02½
Pacific Tin Mines, Alaska.	Feb. 17	Mar. 23	0.02
Penn. Con., Cal.	Jan. 13	Jan. 29	0.10
Posey Canyon, Utah.	Jan. 7	Jan. 25	0.01
Spanish Ridge, Cal.	Jan. 15	Feb. 5	0.02
Sunflower, Cal.	Jan. 30	Mar. 30	0.05
Tetro, Utah.	Feb. 21	Mar. 17	0.03
Wabash, Utah.	Jan. 17	Feb. 8	0.12
West Tonopah, Nev.	Jan. 16	Feb. 15	0.03
Wild Goose, Alaska.	Feb. 1	Mar. 16	0.10
Zeibright, Cal.	Jan. 6	Feb. 1	0.05

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	.....	31.852	.....
March	67.519	.....	31.325	.....
April	65.462	.....	30.253	.....
May	65.981	.....	30.471	.....
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	.....	25.236	.....	107.356	.....
March	25.065	.....	25.560	.....	106.594	.....
April	24.224	.....	25.260	.....	98.625	.....
May	24.048	.....	25.072	.....	102.375	.....
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	.....	August	37.667	.....
March	41.313	.....	September	36.689	.....
April	40.938	.....	October	32.620	.....
May	43.149	.....	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	.....	19.531	.....
March	6.000	.....	19.703	.....
April	6.000	.....	19.975	.....
May	6.000	.....	19.688	.....
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	.....	6.664	.....	25.938	.....
March	6.837	.....	6.687	.....	26.094	.....
April	6.685	.....	6.535	.....	25.900	.....
May	6.441	.....	6.291	.....	25.563	.....
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.